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## Personnel Research

PERSONNEL RESEARCH is a term that has come into use in recent years to denote investigations into the physical and psychological effects of working-conditions upon efficiency, especially in relation to military operations. When we refer to men and women collectively as "personnel", we are thinking of them not as individuals, but as inter-dependent working units in some larger organism. It is the essence of personnel research that the healthy subject is studied in relation to his fitness to perform particular duties.

Before 1939, the Medical Research Council had undertaken a number of *ad hoc* investigations at the request of the armed forces, but the exacting demands of mechanized warfare created the need for a very considerable expansion of research into the factors influencing the efficiency of the human operator of the machines of war and the adaptation of those machines to the capabilities and limitations of those who had to use them.

This symposium is very far from constituting a comprehensive account of all the many personnel problems investigated since 1939. It does not include, for example, a discussion of important work on physiological problems of high-altitude flying—a subject which would provide enough material for a separate number of this Bulletin. The present number should not, therefore, be regarded as more than a representative selection of material.



During the recent war, the growth of personnel research took place under the direction of special committees of civilian scientists and representatives of the armed forces, and it was the Medical Research Council which provided the inspiration, the machinery, and many of the scientific staff necessary for the detailed study of the problems which came before these committees. The first of them was the Flying Personnel Research Committee, which was appointed by the Air Ministry in 1939, a few months before the war, with Sir Edward Mellanby, Secretary of the Medical Research Council, as its Chairman. In 1940, the War Office referred to the Medical Research Council some problems which led to the appointment by the Council of a Body Protection Committee, under the chairmanship of Viscount Falmouth. In 1941, the scope and membership of the committee were extended and, by agreement with the Army Council, its name was changed to the Military Personnel Research Committee. Its secretary was Dr. E. A. Carmichael, of the Medical Research Council. In 1942, the Admiralty requested the Medical Research Council to appoint a similar committee for the study of naval problems, and the Royal Naval Personnel Research Committee was accordingly established. At the Admiralty's suggestion, Sir Edward Mellanby accepted the chairmanship of this committee, which included the Medical Director-General of the Navy, the Director of Scientific Research of the Admiralty, and other representatives of the Medical Research Council, including Dr. G. L. Brown, the committee's secretary, and of the Royal Navy.

Each of these personnel research committees appointed sub-committees for the study of special problems. Among the problems studied were : the physiology of high-altitude flying; clothing of aircrews, guncrews, and others exposed to extremes of temperature or particular hazards; air- and

seasickness; acoustic problems, including protection of hearing; visual adaptation, including the design of instrument-panels and the effects of glare and dazzle; the effects of drugs on performance; selection and training of personnel for general and special duties; pilot-fatigue; analysis of flying-accidents and military-traffic accidents; body-protection and steel helmets; effects of blast; crew-conditions in tank-warfare; parachute-jumping; ventilation and fume-hazards; insecticides; underwater physiology; seating of gun-crews; energy-output of crews of gun-turrets; habitability of warships.

This list indicates, in very general terms, the multiplicity of problems included as the objects of personnel research in wartime. It seems hardly necessary to labour the point that many of the methods employed are suitable for use in peacetime—not only in such obvious fields as civil aviation, but also in the more ordinary personnel problems of industry. Before the war, an organization for the study of the human unit in industry already existed in the Industrial Health Research Board of the Medical Research Council, and during the war some of the Council's staff who had undertaken studies for the Board were transferred to work for the Personnel Research Committees.

One of the consequences of the great extension of personnel research for military purposes may well be the wider application in industrial life of that open-mindedness and spirit of inquiry by which problems previously ignored or treated empirically are accepted as suitable objects of experimental study. Much of the story of personnel research has not been told, but we hope that this symposium will help to show that there are few problems, however simple they may seem, that are not illuminated by the application of the scientific method.

\* \* \*

**ACKNOWLEDGEMENTS.** All but two of the papers published in this symposium are the texts of, or are based upon, communications read at two special series of meetings held by the Royal Society of Medicine on Problems of Protection and Problems of Efficiency. The papers published here include the majority, but not all, of the subjects of the communications at these meetings and, in addition, two papers by Drs. H. D. Darcus & Graham Weddell and Mr. J. S. Weiner which were contributed by special invitation. None of the papers has previously been published.

We are grateful to the Royal Society of Medicine for having allowed us to publish the papers read at its special meetings. By making use of this material, we have derived considerable benefit from the preliminary work of selection and organization undertaken by the Society.

We should also acknowledge our indebtedness to Dr. F. H. K. Green, of the Medical Research Council, for having placed at our disposal information on the organization and responsibilities of the Personnel Research Committees.

## HEAT-STROKE AND HEAT-EXHAUSTION IN IRAQ

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In 1943, at the request of the British War Office, two observers were sent by the Medical Research Council to Iraq, to obtain physiological and biochemical data on cases of heat-stroke and heat-exhaustion.

### Heat Stroke

Very few cases occurred in the summer of 1943, and those that were seen conformed closely to the classical description. A man previously well would suddenly become unconscious with a rectal temperature in the neighbourhood of 110° F. [43.3° C.]. When questioned after recovery, he would usually say that he had suddenly stopped sweating; this was borne out by the fact that on examination the skin was found to be uniformly dry all over the body, including the face.

The fact that sweating stopped so suddenly and so completely suggested a breakdown in the *central* mechanism for heat-regulation. But the cause of the breakdown could not be established. Little information was derived from biochemical examination of the blood and urine. It has often been observed that frequency of micturition is a warning sign of heat-stroke: this was present in most of the cases seen in Iraq. During the first few days after admission to hospital, there was a moderate polyuria; the output of chloride in the urine was normal—a fact which seemed to rule out the possibility of salt-deficiency as an etiological factor. On the other hand, the concentrations of chloride in whole-blood and plasma were reduced; the average values were 74.1 and 88.3 milli-Equivalent per litre, compared with the control levels of 81.9 and 100.4 milli-Equivalent<sup>1</sup> per litre. One explanation of these findings is that the reduced chloride-concentration in the blood was a sign, not of salt-deficiency, but of haemodilution. This hydraemia, and the polyuria, might be caused by failure of sweating and the diminished fluid-loss from the skin. Thus the biochemical changes that were found appeared to be secondary, and to give no indication of the cause of the breakdown.

Experience in the Mesopotamian campaign in 1917, and again in Iraq in 1942, had suggested that heat-stroke was caused by excessive exposure or by overwork. But in the sporadic cases occurring in the summer of 1943 these factors played no part. There was no evidence of any failure in the preventive arrangements of the army. The

patients had not been exposed to undue stress; if anything, they had been under less stress than usual. A number of them had just completed long journeys, coming to southern Iraq from the northern part of the country or from India. They did not become ill during the journey, but usually while resting quietly in transit camps. Because of the history of recent travelling, the cessation of sweating might be attributed to incomplete acclimatization; but this view is open to criticism, since all the cases had been in the tropics for at least several weeks, and it is known that many of the adjustments involved in acclimatization take place in the first few days of exposure to heat. In general, over-exposure to the sun, and overwork, must be regarded as factors precipitating the onset of heat-stroke, but it is clear that they are not the only cause.

### Heat-Exhaustion Type 1

This name has been given to the condition referred to by some authors as "heat-shock". Patients of this type were admitted to hospital suffering from collapse, vomiting and cramps. They showed changes of some interest in the circulatory system. The pulse-rate and systolic blood-pressure were normal when the man was lying down; the diastolic pressure was high and the pulse-pressure reduced. On standing, the pulse became very fast, the systolic pressure fell, and syncope occurred. One practical point emerged from these observations: neither the pulse-rate nor the systolic pressure, taken when the patient is lying down, give any indication of the existence or severity of this type of heat-exhaustion. The diastolic pressure is a much better guide, a high diastolic pressure being a bad sign.

In a small number of these cases the plasma-volume was measured, and was found to be greatly reduced—by 30 % to 50 %. This finding explains the cardio-vascular changes. In the effort to preserve a normal blood-pressure in the face of a reduced blood-volume, there was intense generalized vaso-constriction, manifesting itself by a rise in diastolic pressure. Sweating was profuse, and the skin was cold and clammy, but in spite of this the body-temperature was slightly raised. This was the result of diminished peripheral circulation and the reduced rate of heat-transfer from the inside of the body to the surface.

These patients had a very low urine-volume on admission, and some even had anuria; the urine was highly concentrated, and contained little or no salt. The plasma and whole-blood chloride concentrations were grossly diminished, and the blood-urea was high, reaching levels of 150 to 200 mg. per 100 ml. Protein and haemoglobin concentrations were also above control levels. These changes represent the biochemical picture of dehydration secondary to lack of salt, rather than to lack of water.

However, this state of salt-deficiency cannot be ascribed simply to an inadequate supply of salt. The average salt-intake was about 25 g. a day per man, and it is necessary to compare this with the amount of salt lost in the sweat. It was found that the chloride-concentration of the sweat was higher in the men with heat-exhaustion (average 0.44 g. NaCl/100 ml.) than in controls (average 0.27 g. NaCl/100 ml.). The former would have a negative salt-balance on an intake of 25 g. of salt a day when their daily rate of sweating reached 5.5 litres. This is not a high rate in such a climate as that of Iraq, where men could sweat at the rate of 7 litres a day when working hard. The incidence of heat-exhaustion

<sup>1</sup> [Milli-Equivalent = Equivalent weight  $\times 10^{-3}$  in grams.—Ed.]

type 1 was closely correlated with the peaks of hottest weather. It seemed therefore that these casualties were the direct result of the heat, but that some men were predisposed, by having a high salt-concentration in their sweat, to this type of heat-exhaustion. The problem of discovering beforehand which men are likely to be affected and of instituting preventive measures is difficult, because it is not easy, under field-conditions, to collect sweat and to estimate its salt content.

### Heat-Exhaustion Type 2

The second type of heat-exhaustion, called for convenience "type 2," was a condition in which symptoms predominated over signs. The symptoms consisted of dizziness, palpitation, dyspnoea, lack of sleep, and complaints of inadequate sweating. Usually the symptoms were worse in the heat of the day. At one time it seemed possible that this condition might be a particular kind of "effort-syndrome". Very often these patients said that three or four weeks before, they had had an attack of "prickly heat". As is well known, prickly heat begins as a papular rash, the papules being surmounted by tiny vesicles. As the condition clears up the vesicle bursts, leaving a little ring of scales, and later this scaling spreads. In cases of heat-exhaustion type 2, prickly heat in the healing or scaling stage was constantly present; the desquamation was particularly severe on the arms, legs and back; the face was never affected.

An attempt was made to investigate this skin-condition by objective means, in order to check the claim of inadequate sweating. It was found that the apparently dry desquamating areas of skin had a high surface-temperature (over 100° F. [37.8° C.]). Furthermore, in tests under controlled conditions, patients of this type sweated at a lower rate than normal subjects and were unable to maintain a constant body-temperature. The claim that sweating was reduced was thus confirmed, and it seems probable that the increased severity of the symptoms in the heat of the day was the result of defective sweating and the consequent rise in body-temperature.

It should be emphasized that these cases differed from those of heat-stroke in three respects: i. The onset was gradual, not sudden. ii. The failure of sweating was partial; some areas of the body, particularly the face and flexor surfaces, sweated well, while other parts were dry. iii. The changes in the skin that have been described were nearly always present, and their severity was parallel to the severity of the general condition; in cases of heat-stroke the skin was normal or showed but a mild degree of prickly heat in the acute stage. These three facts suggest that the two conditions are etiologically distinct and that the failure of sweating in heat-exhaustion type 2 was the result of local causes.

An attempt was made to discover what these causes were. Investigation of the pathology of the skin showed no well-marked changes. However, physicians of the Australian Army in New Guinea have described a similar syndrome in which, by means of serial sections of the skin, they found blocking of the superficial parts of the sweat-ducts and

cystic dilatation of the ducts beneath the block. In the cases in Iraq, it was found that the chloride-concentration of the sweat, measured after recovery, was considerably higher than normal (0.53 g. NaCl/100 ml., compared with the control level of 0.27 g. NaCl/100 ml.). It was thought that this increase might be a phenomenon of fatigue. The higher the chloride-concentration of the sweat, the less osmotic work the glands have to do; fatigue might lead first to impairment of the power to do osmotic work, and finally to complete cessation of function. In support of this view was the fact that cases of this type occurred with increasing frequency towards the end of the summer, and not in relation to the peaks of temperature.

Another feature of this syndrome was a very marked polyuria; the men complained of frequency of micturition, and in the wards they passed enormous quantities of urine, sometimes 8 to 10 litres a day. The total chloride-output was within normal limits; there was a moderately-reduced chloride-concentration of the plasma, but no other abnormality in the blood. In these respects, except that the polyuria was more profuse, such patients resembled cases of heat-stroke.

It has not been possible to explain the connexion between the various features of this syndrome: polyuria, reduction in plasma chloride-concentration, partial failure of sweating, and a scaly lichenified condition of the skin. The Australian observations suggest that a lesion of the skin is the cause of the defective sweating; the reverse however is also possible. Acute prickly heat is so common in a climate such as that of Iraq that it cannot be considered abnormal. Whenever skin which is the seat of acute prickly heat becomes dry for any reason, for instance during the cool of the night, the prickly heat begins to heal. Desquamation is characteristic of this process. If, because of fatigue of the sweat-glands, sweating began to fail, prickly heat on the dry areas of skin would begin to heal. This explanation would harmonize with the statement made by a large number of patients, that symptoms began just when their prickly heat began to disappear.

The simplest explanation of the polyuria would be that it was secondary to polydipsia, and that this occurred because the men felt dry and hot. The possibility was also considered of diminished secretion of the pituitary anti-diuretic hormone, but pituitrin in a small number of cases was found to be ineffective in curing the polyuria.

Finally, it should be emphasized that heat-exhaustion type 2, as seen in Iraq, was not a condition in which there was danger to life. No case developed into heat-stroke. But it was important from the military point of view because the incidence was high and the rate of recovery slow. It therefore involved a great wastage of manpower. With rest, normal sweating was gradually restored; none of the measures that were tried increased the rate of recovery, and no specific method was discovered either of prevention or of cure.

As a result of the field-investigation, new problems were defined, some of which in the subsequent years were investigated in greater detail in the laboratory of Dr. Ladell<sup>2</sup>, the senior member of the Medical Research Council's team in Iraq.

<sup>2</sup> [See *BMB* 1013.—Ed.]

## EFFECTS ON MAN OF HIGH TEMPERATURES

With special reference to the work of the Heat Physiology Team at the National Hospital

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- 1 Problems for investigation
  - 2 Acclimatization
  - 3 Tolerance of raised body-temperature
  - 4 Fatigue of sweat-glands
  - 5 Physical limitations of evaporation
  - 6 Some other problems studied
- References

All the military services have had to contend with heat during the late war. Desert-heat with dry-bulb temperatures up to 125°F. [51.7°C.] and sun temperatures of 160°F. [71°C.] or more, and jungle-heat with temperatures of 90°F. [32.2°C.] and almost full saturation, were encountered by the Army; and the Royal Navy has had its own peculiar problems in the tropical seas in gun-turrets, where ventilation is at a minimum and temperature and humidity are both high, and in engine- and boiler-rooms where radiant heat adds to the burden (Critchley, 1945).

The heat physiology team at the National Hospital, Queen Square, London, under the direction of Dr. E. A. Carmichael, has attempted in the last four years to determine (a) what are the limits of tolerability of heat, (b) in what way the effects of heat may be mitigated, and (c) how, if at all, a man's tolerance to extreme heat may be increased. With the exception of one summer spent in Iraq by two members of the team, and another summer spent by another member in India, in connexion with armoured warfare, all the work has been done in "hot-rooms" in Britain, using subjects who were exposed to "tropical conditions" only during the actual experimental periods each day. Two pilot experiments have been done where the subjects remained in the hot-rooms 24 hours a day for periods up to 14 days, but no detailed results are available from these as yet.

### 1. Problems for Investigation

Primarily the problem of heat appeared to be a physical one. The heat produced by the body must be lost to the environment if the body-temperature is not to rise; the heat-loss is by convection, by radiation and conduction, and by evaporation. When the air-temperature is above the skin-temperature, heat is gained and not lost by convection, and if surrounding objects are also at that temperature, conduction and radiation are also adding to

the heat-load of the body; in these circumstances, all the heat-loss must be by evaporation. When the air-temperature is not much below the skin-temperature, as is often the case in the tropics, convective loss is relatively small and so, again, evaporative cooling is most important. It is possible to calculate the amount of sweat that must be usefully evaporated to dissipate the metabolic heat, and this calculation has been useful in estimating the ventilation needed in tanks. In general, however, the physics of evaporation from the human body and the physiology of sweating have proved too complex for fixed rules to be formulated from theory alone, without experiment.

In an environment where most of the heat-loss must be by evaporation, the body-temperature usually rises; whether or not this rise is halted early depends upon:—

- i. The capacity of the body to produce enough sweat to be evaporated in sufficient quantity for cooling.
- ii. The capacity of the atmosphere to evaporate the necessary amount of water quickly enough.

The rate of evaporation is a function of humidity and of air-movement; but at temperatures above the skin-temperature the greater the air-movement the greater the convective heat-gain, and so the greater the total amount of

FIG. 1. GENERAL VIEW OF HOT-ROOM THROUGH OBSERVATION-WINDOW



FIG. 2. HOT-ROOM, SHOWING RADIATION-PANELS AND GLOBE-THERMOMETER

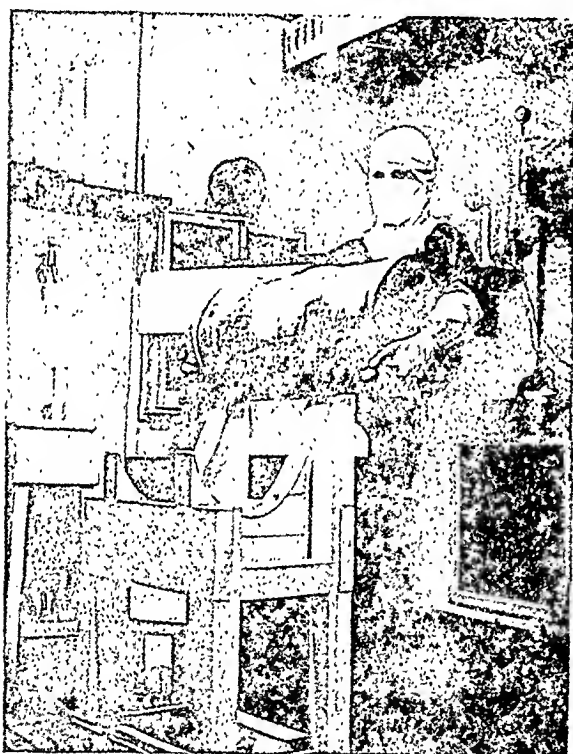


FIG. 3. HOT-ROOM TEAM WITH OBSERVER



Two of the team are in antiflash clothing and the other two in shorts

FIG. 4. WORK IN THE HOT-ROOM



The subject is wearing antiflash clothing and carrying a dummy cordite-charge weighing 168 pounds [76.2 kg.]

heat to be lost by evaporation. As a first generalization, the physical factor of rate of evaporation is the limiting one in many cases, as the healthy man, after a slight initial rise in rectal temperature, usually produces more than enough sweat to cover his evaporative needs, and except in hot dry environments and with considerable air-movements there is always some unevaporated sweat; this may serve a physical function in maintaining the maximum evaporating surface. But although very high rates of sweating are needed and, in fact, found in extreme conditions (rates of 60 cm.<sup>3</sup> per minute have been recorded), such rates cannot be maintained by the sweat-glands for more than about 30 minutes (Ladell,

1945a); nor are these rates achieved without preliminary training, i.e. acclimatization in the heat, and they are found only when the rectal temperature is considerably raised, in some cases up to 103° or 104°F. [39.4°C. or 40°C.]. Hence, though physical factors determine the limit in certain cases, physiological factors must be considered when extremes of temperature and humidity are to be endured.

The problems before us were:

*Acclimatization.* Of what value is preliminary hot-room training in increasing a man's ability to withstand heat; and what are the mechanisms involved in acclimatization?

*Tolerance of raised body-temperature.* The high rates of sweating required in extreme environments can be obtained only when the body-temperature is raised. How do men react to continued raised body-temperature?

*Fatigue of sweat-glands.* How long will a man continue to sweat at a steady high rate?

*What are the physical limitations, in the shape of humidity and air-movement, to adequate evaporation?*

## 2. Acclimatization

This has been studied in detail by the team, in particular by Dr. B. McArdle. Briefly, the first time a man goes into the heat he sweats poorly, his rectal temperature rises and he is not able to do much work. With successive exposures to heat and with working in the heat, his rectal temperature does not go so high, he sweats more, and his capacity to work in the heat is increased. Sweating starts at a lower rectal temperature, and later reaches a higher rate for a given rectal temperature. At the same time his cardiovascular system becomes adjusted, probably because of the increase in the plasma-volume which occurs after exposure to heat (Bazett, Sunderman, Doupe & Scott, 1940) and which we found to develop within a few hours of the first exposure.

## 3. Tolerance of Raised Body-Temperature

This has not been studied separately. In the course of the work, however, we have found considerable variation in tolerance; in general, the unacclimatized man appears to be more tolerant of a high rectal temperature than is the acclimatized subject, but this is largely because the acclimatized man gets a high temperature only after working far harder than can the unacclimatized man. Men are apparently physically efficient and able to continue for periods up to two hours with rectal temperatures of 102°F. [38.9°C.]. But, for other reasons, and as a result of continued observation and personal experience, a limit of 101°F. [38.3°C.] has been taken as an acceptable upper limit; if, under a given condition of clothing, work and environment, a man's rectal temperature goes above this level and remains above it for more than two hours, we consider that that set of conditions should be regarded as intolerable.

The psychological and psychomotor reactions to a raised body-temperature, and of being in the heat were studied to a small extent by Drs. J. Weiner & J. C. D. Hutchinson (1945) at the National Hospital, and more elaborate work in this field was done by Dr. N. H. Mackworth (1946) in Professor F. C. Bartlett's laboratory at Cambridge.

#### 4. Fatigue of Sweat-Glands

The sweat-glands appear to fatigue readily at high rates of secretion (Ladell, 1945b). Sweat-rates of more than 20–25 cm.<sup>3</sup> per minute are not maintained for long periods. The higher the maximum rate of sweating attained, the quicker does the rate fall away even though the environmental conditions remain the same. This is not, however, of great practical importance because :

- i. In practice, conditions under which high rates of sweating are required never continue for long; *e.g.* in a gun action at sea the maximum rate of fire is seldom if ever maintained for more than 30 minutes.
- ii. In hot wet environments, where the high sweat-rates are encountered, there is always more sweat produced than is required for evaporation, and so a decline in sweat-production does not have any effect on the cooling until a considerable reduction has occurred.

The decline of sweat-rate after a certain length of time takes place whether the subject is replacing his water (and salt) losses or not. The effect of water-intake and of dehydration on the rate of sweating is not marked (Ladell & Weiner, paper in preparation).

#### 5. Physical Limitations of Evaporation

It might be expected that the physical limitations to evaporation could be simply determined by finding experimentally the limiting conditions of air-movement and humidity beyond which cooling was inadequate and the body-temperature rose. In practice it was not usually possible to do this, as intolerability is not always indicated by a steadily rising body-temperature. Subjects often failed before this point was reached; the cause was usually a failure in the circulation. Limiting environments cannot therefore be estimated from purely theoretical consideration of heat-exchange, as has been attempted by some.

The failure in the circulation in heat was studied by two members of the team, Drs. Weiner and Hutchinson, on the tilting-table. They found that pooling of blood in the legs was no greater in the heat than in the cold; nevertheless fainting occurred much sooner in the heat.

Actual limiting environments differ according as to whether the subjects are working or resting, and according to their rate of work. With an increased heat-production due to work there is a change in the heat-storage indicated by the higher rectal temperature and there is an increase in the sweat-rate. Clothing also affects the heat-loss; the effect both on temperature and on sweating is more marked in working than in resting individuals, and is least marked with high wind-velocities under hot dry conditions.

A series of experiments in which the only variable has been air-movement showed that absence of air-movement is far more deleterious than we had expected from certain published work. The effect of low air-movement is particularly noticeable at high humidities, especially when the dry-bulb temperature is high.

The points taken into consideration in deciding whether a given environment should be regarded as intolerable or not have been, for our purposes :

- i. Whether one or more subjects in the group fail to stay the course of four hours.
- ii. A final rectal temperature, *i.e.* after work, above 101°F. [38.3°C.].
- iii. An average sweat-rate over the whole period of more than 1,250 cm.<sup>3</sup> per hour.
- iv. A final (after work) pulse-rate of more than 140 per minute.

By applying these criteria to our results we have been able to draw contour-lines showing the limiting environments for different conditions of work and clothing (Heat Research Team, 1944–45). Such contour-charts bring out certain points of interest. Thus, for men working in shorts :

An increase in air-movement from 10 to 25 feet<sup>1</sup> per minute raises the wet-bulb tolerance by 1°F. at high humidities, and by 2°F. at low humidities.

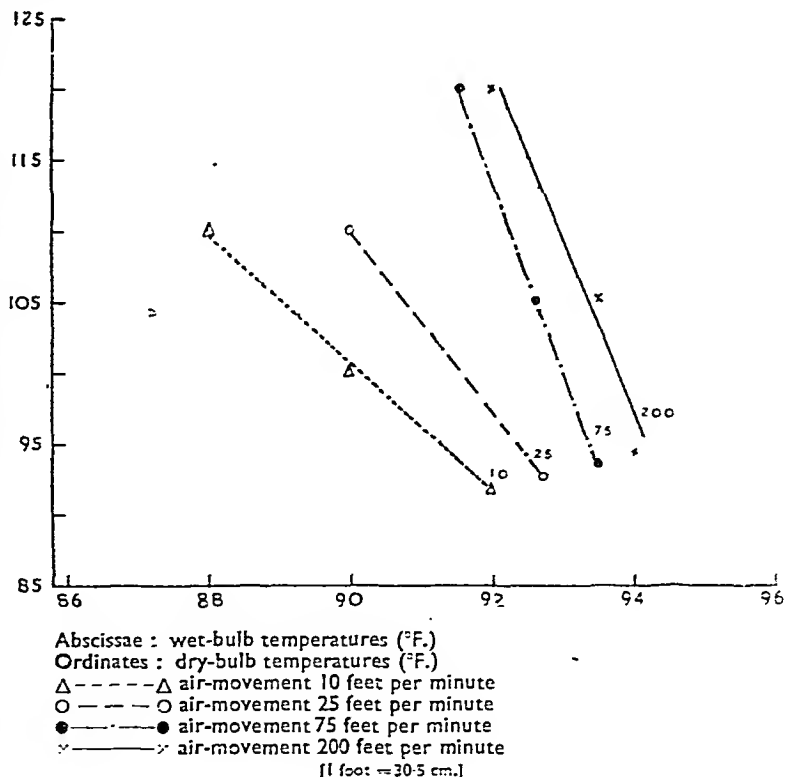
The same increase in air-movement increases the dry-bulb tolerance by 10°F. at low humidities and by 5°F. at high humidities.

An increase in air-movement from 75 to 200 feet per minute increases the wet-bulb tolerance by only 1°F. and the dry-bulb tolerance by 10°F. at all humidities.

By combining the various contour-lines and adding certain other results it is possible to construct a nomogram, from which the physiological effect of any given environment and set of conditions may be predicted.

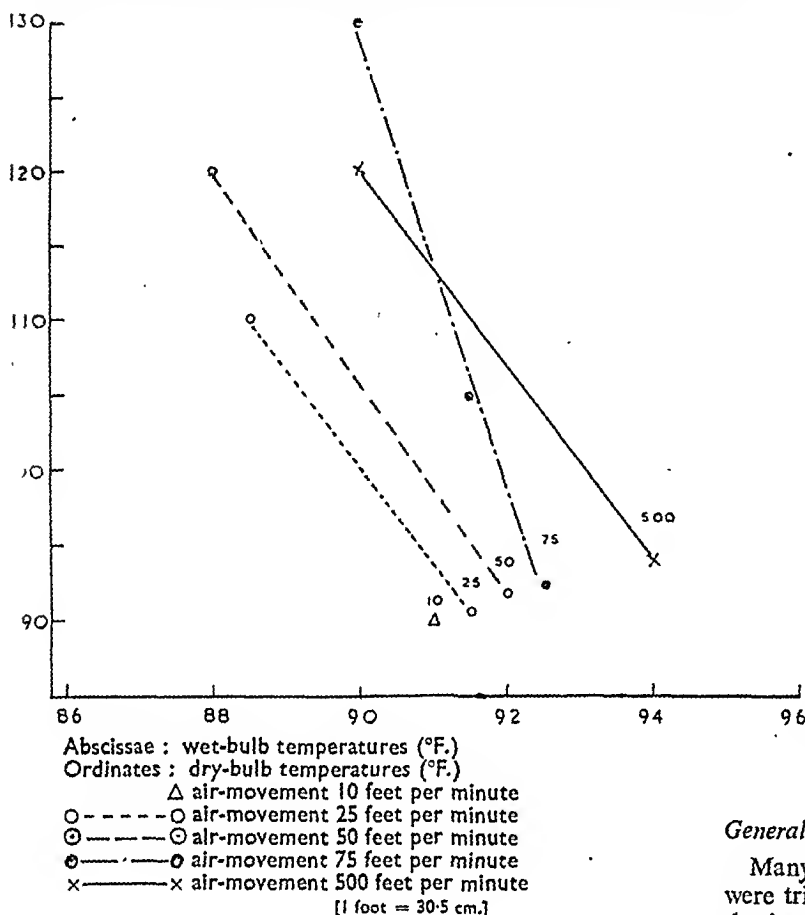
<sup>1</sup> [1 foot = 30.5 cm.—Ed.]

FIG. 5. CONTOUR-LINES OF LIMITING ENVIRONMENTS FOR MEN IN SHORTS WORKING AT 170 kg.cal. PER HOUR





**FIG. 6. CONTOUR-LINES OF LIMITING ENVIRONMENTS FOR MEN IN SHORTS WORKING AT 196 kg.cal. PER HOUR**



## 6. Some Other Problems Studied

In addition to the main and latest work of the team on limiting environments, there was also other work of importance in tropical warfare; these will be considered very briefly.

### *Armoured Warfare.*

In tanks, conditions can be much worse inside than outside, owing to the heat from the engines and the moisture from the crew's breath and sweat. Dr. McArdle (1944) has designed and tested a ventilated belt which brings outside air straight under the clothes of the men in the tank and allows them to carry on under conditions which would otherwise be physiologically intolerable.

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### *Tropical Clothing.*<sup>2</sup>

A large number of different fabrics was tested to determine their effects upon heat-loss from the body. It was found that a thin, closely-woven, and hence mosquito-proof, fabric did not interfere with heat-loss any more than a loosely woven aertex-type fabric. In general, the thicker the fabric the more it impeded heat-loss (Ladell, 1944).

### *Immersion Suits*

Dr. Hutchinson (1944) showed that an impermeable immersion suit when worn in air at temperatures above 90°F. [32.2°C.] was physiologically intolerable; hence one-man-submarine operators, for example, were advised not to don their suits until as late as possible, and should doff them as soon as surfacing. Similar work was done by Hutchinson on other types of diving-suits to determine how long the suit could safely be worn on the deck by a man waiting to dive. Once in the water, even in swim-suits, Hutchinson found that the body-temperature fell in sea temperatures as high as 80°F. [26.7°C.].

### *Anti-G-Suits*<sup>3</sup>

In hot environments, the influence of each extra layer of clothing on the heat-loss is very marked. Experiment showed that it was almost essential to incorporate the Anti-G-suit in the ordinary flying-suit in the tropics (Hutchinson, 1944).

### *General Equipment*

Many different items of equipment and certain weapons were tried out in the hot-rooms to determine their effect on the heat-balance of men wearing or carrying them. Other items were tested on their own account to determine the effect of heat upon them and, hence, their durability under tropical conditions.

**ACKNOWLEDGEMENTS.** I wish to thank my colleagues of the Heat Research Team for permission to quote from their results, and for their help in preparing this paper; and especially to Dr. McArdle for the loan of charts and for valuable criticism.

<sup>2</sup> [See also *BMB* 1016.—Ed.]

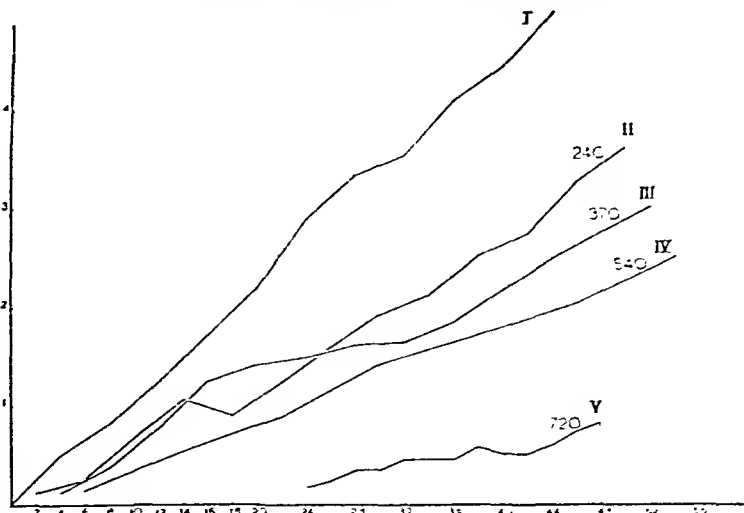
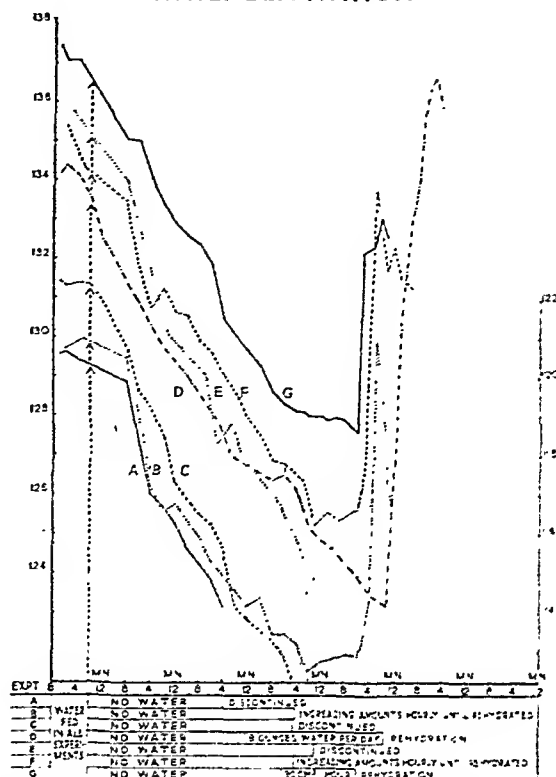
<sup>3</sup> [Suits designed to protect the pilot of an aircraft from the vascular effects of acceleration.—Ed.]

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W. S. S. LADELL B.A. M.B. B.Ch.

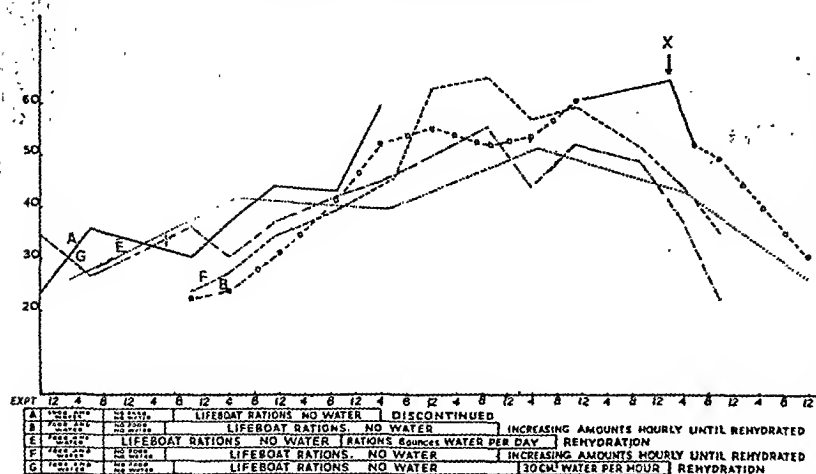
- 1 Physiology of water-lack  
2 Lifeboat-rations  
3 Possible measures for increasing water-supply in  
4 lifeboats  
5 Water-rations in the tropics  
6 References

The preliminary experiments showed that there is a rapid fall in body-weight when little or no water is being taken (fig. 1). This is due to the cumulative water-debt which is contracted within the body as water is lost in the breath, through the skin, and in the urine. By gradually increasing the water-intake until the weight-loss was halted, it was found that a water-intake of between 800 and 900 cm.<sup>3</sup> per day was needed to maintain water-balance in a temperate climate (fig. 2). When the water-intake is insufficient to prevent water-debt, the rate of urine-secretion falls off, until after about 24 hours it reaches a minimal, basal, level below which it never falls, even when there is complete deprivation of water. This basal level of urine-secretion varies according to the diet; on a carbohydrate diet it may be below 300 cm.<sup>3</sup> per day, but on a protein diet it is as much as 500 cm.<sup>3</sup> per day. While the volume of urine is falling, the blood-urea is rising; we found that after 24 hours without water the blood-urea was between 50 and 60 mg. per 100 cm.<sup>3</sup> and it remained at this level until drinking was started (fig. 3).



Abcissae : time in hours  
Ordinates : % weight-loss  
I : 2 subjects (WSSL & RJR), 5 experiments ; day 2, 3  
II : 1 subject (WSSL), 1 experiment ; day 3, 4  
III : 2 subjects (WSSL & THG), 1 experiment ; day 2, 3  
IV : 15 subjects (Royal Naval Hospital, Haslar) ; day 2, 3  
V : 1 subject (WSSL), 1 experiment ; day 4  
Arabic numerals on the graph show water-intakes in cm.<sup>3</sup> per day



**FIG. 3. BLOOD-UREA CHANGES DURING WATER-DEPRIVATION**

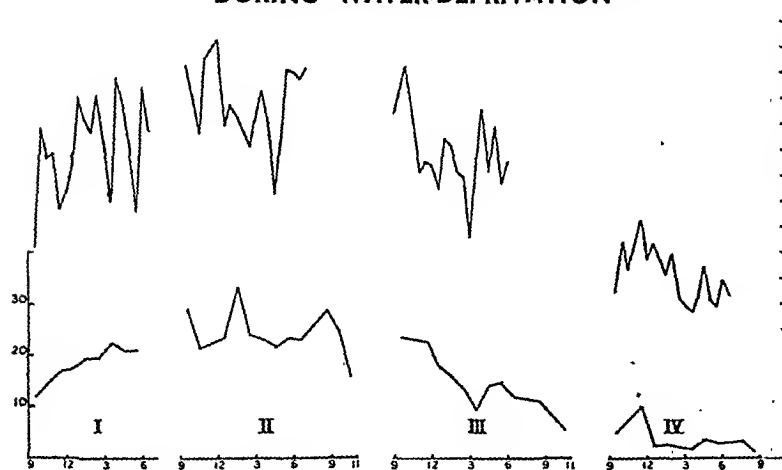
Abscissae : time in hours

Ordinates : mg./100 cm.<sup>3</sup>

A, B, E, F, G : subjects of experiments (for explanation, see fig. 1)

X : sample unsatisfactory

From further experiments, and detailed examination of the early experiments, we showed that the physical deterioration ran parallel with the weight-loss. A 5% loss in body-weight, obtained after 24 hours' abstention, was tolerable; but with a 10% loss, such as occurred after 60 hours' deprivation, gross deterioration, physical and mental, began to set in. There was a general weakness rather than a specific failure of one or more systems; even after 3 days' total deprivation, a subject could still rally himself to perform an exercise-tolerance test efficiently, and though on walking there might be a foot-drop, neurological examination showed no muscular weakness or changes in the reflexes.

**FIG. 4. CHANGES IN SALIVARY ACTIVITY DURING WATER-DEPRIVATION**

Abscissae : time in hours

Ordinates : Right side (upper) : wetness (mg. increase in weight of standard piece of lint in standard position, within mouth, in 2 minutes)

Left side (lower) : volume of saliva in cm.<sup>3</sup> collected by sucker in 15 minutes

I : water fed

II : first waterless day

III : second waterless day

IV : third waterless day

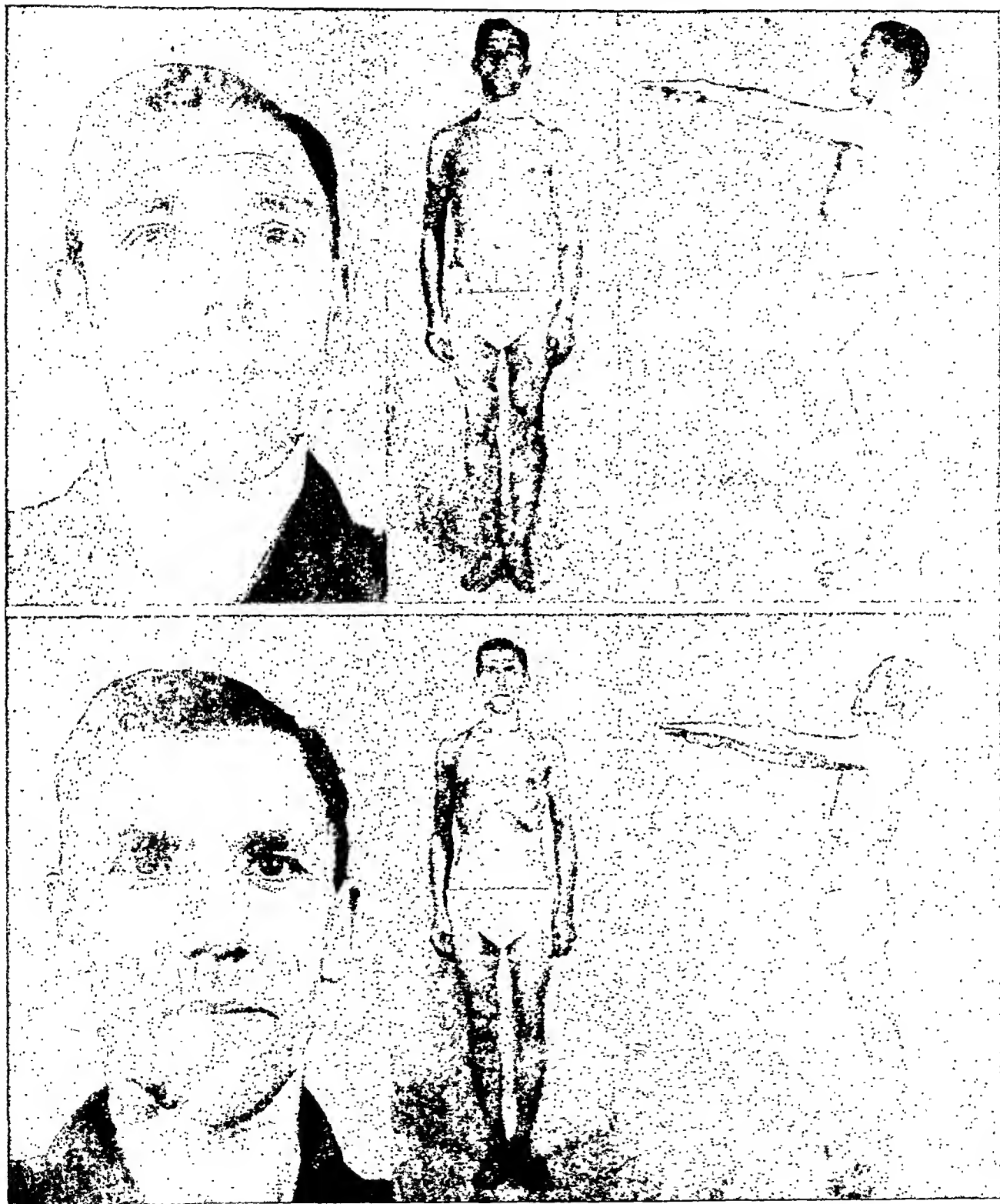
The rate of weight-loss during the first 24 hours without water is greater than the subsequent rate of loss. Urinary secretion is still at a high level, and there are no obvious signs of water-lack. Thus, the rate of salivation does not decline until there have been nearly 36 hours' without water (fig. 4). Moreover, water given during the first 24 hours never saved body-water, but swelled the urine-volume by the amount taken. We concluded, therefore, that there is in the body what could be called free circulating water, normally used for such things as the intestinal secretions, which are only temporarily lost to the body during digestion and are then reabsorbed. Until this water has been utilized it is un-economical to start taking the limited water-ration. We therefore recommended that for the first 24 hours adrift no water should be taken.

## 2. Lifeboat-Rations

In the course of these experiments it was found that certain of the constituents of the Ministry of War Transport Ration had a diuretic effect on men even when in severe water-debt. Thus the urinary excretion of one subject was doubled, over a three-hour period, after taking 1 ounce [28 g.] of pemmican; there was a compensatory reduction in urinary secretion later. This effect was traced to the nitrogenous extractives present in the pemmican and also to the protein in it. The urea resulting from the metabolism of protein has itself a diuretic effect. Fats and carbohydrates do not increase the urinary output. An alteration in the lifeboat-ration was therefore proposed. The old ration consisted of one ounce each per day of pemmican, of malted-milk tablets (both containing protein), of biscuits and of chocolate. The calorific value of this was 400 Cal., and the basal urine-volume on such a diet was 500 cm.<sup>3</sup> per day. The proposed new ration consisted of one ounce each of dehydrated butter-fat or margarine, special high-fat-content biscuits, chocolate, and sweetened condensed milk (this is relatively low in protein). This ration provides 500 Cal. per day, and the basal urine-volume was found to be below 400 cm.<sup>3</sup> per day, a considerable saving.

A lifeboat carries 112 ounces [3.18 l.] of water per person. It was customary to ration this at the rate of 8 ounces [230 cm.<sup>3</sup>] per day for 14 days. But with a water-intake of only 8 ounces daily, we found experimentally rapid deterioration; and in actual practice there had been cases where survivors had succumbed to water-lack while on this ration, lifeboats being found with people dying of thirst while there was still water in the breakers. Some other rationing plan was therefore necessary to make the best possible use of the limited water available for keeping survivors in good condition as long as possible. We had found that, although not in water-balance, men with an intake of 500-600 cm.<sup>3</sup> of water per day remained in moderately good condition (see fig. 5); we therefore devised and recommended the following plan. (Medical Research Council, 1943.)

FIG. 5. EFFECTS OF RESTRICTED WATER-SUPPLY



Upper photographs show subject immediately before restriction of water-rations  
Lower photographs show subject on the tenth day of the regime recommended in the text  
(immediately before the experiment was terminated)  
This subject had a sea-water supplement of 180 cm.<sup>3</sup> per day on days 2-6 inclusive

Day 1— no water.

Days 2-6— 18 ounces (512 cm.<sup>3</sup>) per day.

Thereafter—the remaining 22 ounces [625 cm.<sup>3</sup>] to be given in token quantities only, say 2 ounces per day, to maintain morale.

One large-scale experiment was carried out on volunteer naval ratings, at the Royal Naval Hospital, Haslar, in which water-supplies were utilized in this way (Ladell, 1943). There was excellent correspondence between the observed and the predicted body-weight changes during the period of relatively high water-intake; but on the token-intake only, deterioration was not so rapid as had been expected. This suggests that there may be, in a slow dehydration, some acclimatization or habituation to water-lack. In a more rapid dehydration, however, there is not time for this to take place, and weight-loss is sometimes more rapid than expected.

### 3. Possible Measures for Increasing Water-Supply in Lifeboats

Various measures of increasing the water-supply were investigated:

#### *Drinking Seawater*

The kidney can excrete only up to 2% sodium chloride, whereas seawater contains 3.5%. But if the ration is almost salt-free, as it is, and as some urine is always excreted, it should be theoretically possible to drink small quantities of seawater without drawing on the body-water to excrete the salt, or accumulating salt in the body. A number of experiments was therefore carried out in which subjects drank either saline or real seawater (Ladell, 1943). In theory, the maximum permissible amount of seawater that can be drunk is 400 cm.<sup>3</sup> per day, taken in small instalments throughout the day; in practice we found that any seawater drunk promoted a diuresis; but at intakes of less than 400 cm.<sup>3</sup> per day, the increase in the urine-volume was less than the volume of seawater drunk; there was, therefore, a net gain of water to the body. At very low intakes, this gain

amounted to about one third of the seawater drunk, but at 400 cm.<sup>3</sup> per day the gain was less. The effect of this increased urine-volume and slight water-gain was shown by the lower blood-urea (fig. 6). When more than 400 cm.<sup>3</sup> of sea-water is drunk daily, the urine-volume rises still more; there is an extra drain on the body-water and also some accumulation of salt within the body. Hence larger amounts of seawater are definitely dangerous (Elkinton & Winkler, 1944). Because of the difficulty of limiting to the safe level the amount of seawater to be drunk, and of the very great danger of taking too much, the Committee did not recommend the actual drinking of seawater; but it did sanction the dipping of biscuits into the sea, and rinsing the mouth with seawater. For my part, I would have no hesitation in drinking up to the prescribed amount were I ever a castaway.

#### *Salvaging the Breath-Moisture and Body-Stills*

Dr. Hutchinson and also Dr. G. L. Brown constructed several ingenious apparatuses in which the water in the breath was condensed, but the volume recovered each day was so small, about 150 cm.<sup>3</sup>, that it would have been more economical to utilise the space taken up by the apparatus to carry water. Body-stills, in which heat from the body was used to distil seawater, were made by Dr. Hutchinson, but these were also unpractical and never adopted.

#### *Fuel- and Sun-Stills*

There has recently been some success in producing a fuel-operated still which is economical of space. The RAF have an excellent sun-still in their rubber dinghies.

#### *Desalting Apparatus*

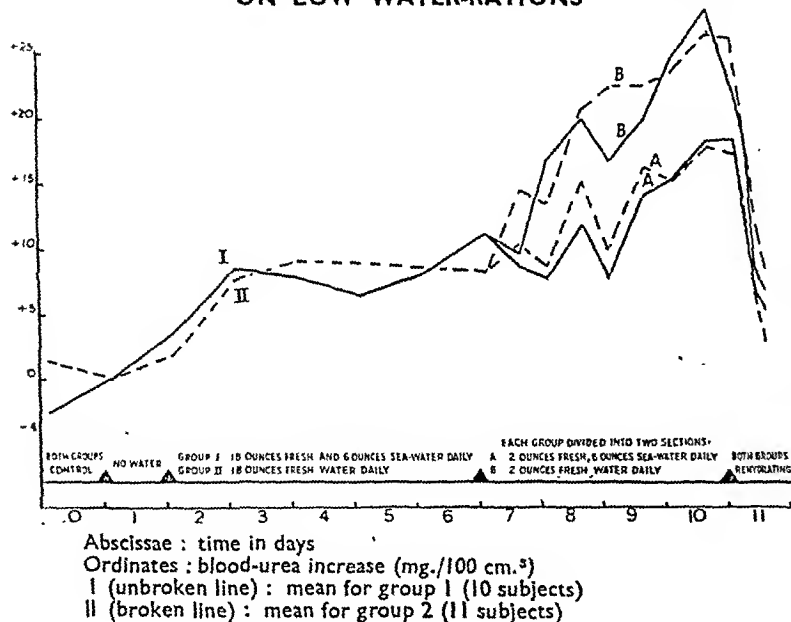
In Dr. B. S. Platt's laboratory, and later in the laboratory of the Water-Pollution Research Board, a mixture of ionic-exchange resins which removes the acid- and the alkaline-ions together has been developed. A potable and palatable water is obtained from seawater. The final model adopted by the RAF gives 6 volumes of water for each volume occupied by apparatus and reagents.

### 4. Water-Rations in the Tropics

Water-rationing in lifeboats leads us to the question of water-rationing in the tropics. In a hot climate, water-losses are very great owing to the heavy demands of the sweat-glands. A man deprived of water in the tropics becomes dehydrated very quickly; thus one subject deteriorated more in 12 hours without water in Iraq, with the air-temperature 100°-105°F. [37.8°C.-40.6°C.], than he had done in 4 days of deprivation in England. In such rapid dehydration there are definite signs of circulatory failure, which are not apparent in the slower dehydrations carried out in England. Direct observation in Southern Iraq showed that healthy men might regularly be sweating 10 litres per day; a survey carried out before the height of the summer showed that men were drinking, on an average, nearly 7 litres of water or other fluids per day. Nevertheless, they were all producing less than 1,000 cm.<sup>3</sup> urine daily. During the very hot weather many men lost weight, the rate of urine-secretion fell to near the basal level seen in water-debt, and the blood-urea rose. We

*Continued at foot of page 13*

FIG. 6. CHANGES IN BLOOD-UREA DURING A 10-DAY PERIOD ON LOW WATER-RATIONS



## EFFECTS OF A TROPICAL CLIMATE ON MEN IN WARSHIPS

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- 1 Effective temperature scales
  - 2 Thermal environment of the men
  - 3 Health of the men
  - 4 Effect on efficiency
  - 5 Conclusion
- References

It is generally acknowledged that the efficiency of a ship's company depends largely upon the conditions in which it lives and works. The efficiency of the ship as a fighting unit however depends on attaining a reasonable balance between the requirements of material and those of personnel,

and this is rarely a simple problem. The amount of equipment and the numbers of men who can be safely fitted into any ship fall within certain closely defined limits if the addition of excessive topweight, which may alter the stability of a ship and possibly cause it to capsize, is to be avoided.

During the early years of the recent war, a satisfactory balance between material and personnel was difficult to achieve. Vast increases of offensive and defensive equipment and additional men to operate the new weapons had to be accommodated in warships, to prosecute the war against the enemy in submarines and in the air, as well as in surface craft. Close-range weapons and high-angle guns were greatly increased in numbers. Aircraft-carriers carried more aircraft, aircrews and maintenance staff, than were ever envisaged by their designers or builders. The loss of certain ships, partly because of slow flooding along the mess-deck flats and ventilation trunking, caused emphasis to be placed on the control of flooding by turning the ship into a series of watertight sections and compartments. The valves controlling the fresh-air supply to many parts of ships were closed whenever action was imminent. All these factors detracted from the standard of living and working conditions which could be maintained, especially in warm climates, but at that time the effort was primarily concentrated on material considerations rather than on those of the personnel. Ships were being produced by the building yards at a maximum rate to fight the Battle of the Atlantic, and the first requirement was to clothe and equip the ships' companies for arctic warfare.

After the surrender of the Italian Fleet in 1943, and the immobilization of the majority of effective German Units

### EFFECTS ON MAN OF RESTRICTED WATER-SUPPLY

*Continued from page 12*

concluded from this that the weight-loss was due to dehydration, and we put forward the doctrine that every man should drink sufficient to produce "at least a beer-bottle and a half" [about 850 cm.<sup>3</sup>] of urine each day. Thirst is a very poor indicator of water-need; in conditions where the water-turnover is high, a man left to drink according to his fancy rarely drinks sufficient and he becomes voluntarily dehydrated; this has been shown particularly by Adolph (1943) in America.

Where there is sweating, salt-intake is as important as water-intake. In Southern Iraq, water-supply was adequate and the men were trained to drink enough, yet there were many cases of dehydration; we found this to be a salt-deficiency dehydration. At high steady rates of sweating a large amount of salt may be lost each day and this must be replaced. In the hot-room we have found sweat containing up to 0.6% of sodium chloride; but in the field we rarely got a sample from a healthy man containing more than 0.33%, and the average for all our samples was 0.29%. This discrepancy between "field-sweat" and "hot-room sweat" is well known. We have been able (Ladell, 1945) to show its cause:—

- i. In the hot-room, the rate of sweating is usually very much greater than in the field, as conditions are more severe and the subject is made to work harder. The greater the rate of sweating, the higher the chloride content of the sweat.
- ii. Sweat-glands are susceptible to fatigue. A sweat-gland when fatigued excretes sweat with a higher concentration of chloride than when fresh. Thus, the longer a man sweats

the greater the chloride content of his sweat. This fatigue-phenomenon is more marked in subjects who go into the heat only for a few hours each day than in subjects who live in the heat, either in a tropical country or in the hot-room. If a man lives in the heat, his sweat-glands become less susceptible to fatigue, and the increase in chloride-content with lengthening duration of sweating is not found. This is a type of acclimatization.

- iii. We have shown that the greater the salt intake the greater the chloride-concentration in the sweat. In the field, men are not so salt-conscious as in the hot-room, and they probably take less salt.

The actual salt-requirement is simply calculated by taking 0.35% as a safe upper level for the chloride-content of the sweat. If a man is going to sweat 10 litres per day he will lose about 35 g. of sodium chloride daily. This must be replaced, and he should also have a little in reserve, say 5 g., for any sudden extra work; it will usually not be needed and will be found in the urine. The total intake aimed at therefore must be 40 g. per day; 15 g. will always be provided by the food, without any flavouring, the rest should be taken as cruet, as salt tablets, and in the drinking water.

ACKNOWLEDGEMENTS. I wish to thank Dr. E. A. Carmichael for his help and encouragement during many of the experiments described in this article, and I am indebted to Dr. B. S. Platt for his concept of water-debt.

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in northern Europe, the imminence of an extended campaign at sea against the Japanese raised once more the question of whether the British ships, which had operated effectively in temperate and northern waters, would be able to adapt themselves satisfactorily to the tropics, where the seawater, at temperatures ranging from 80 to 90°F. [26.7 to 32.2°C.], would act as a warm water bath for the ships, instead of exercising the cooling effect it does in home waters; the moisture content of the air would be 2-3 times as great; and the ships' superstructures would be exposed throughout the day to the tropical sun.

In order to provide the Naval Staff with a reliable measure of the effect of the changed climatic conditions on efficiency, the Medical Research Council was asked by the Admiralty in May, 1944, to define the upper desirable limits of environmental warmth, for working and living compartments in ships, which were compatible with reasonable efficiency and health; and secondly, to estimate the loss of efficiency and health which would accrue if these limits were exceeded. A Sub-Committee of the Royal Naval Personnel Research Committee was set up to deal with these problems, and, at a later date, this Sub-Committee was asked to consider more general problems of warship habitability.

A preliminary recommendation based on the knowledge available at that time was made to the Admiralty, employing the American Effective Temperature Scale which appeared to be the most suitable measure of warmth available.

### 1. Effective Temperature Scales

The Effective Temperature Scale, first constructed by the late Commander Houghton of the United States Navy, & Yagloglu in 1923, expresses in one figure the combined effects of air-temperature, humidity, and air-movement upon the comfort-sensations of individuals. The scale is referred to standard conditions of still and saturated air. The normal effective temperature of an environment within a compartment therefore indicates that temperature of still air saturated with water-vapour in which an equivalent sensation of warmth, to that experienced by those in the compartment, would be reported by the average man or woman. The other reactions of the body to warmth have been found to correspond closely to the warmth sensations in relation to this scale. The recommendation made, which was largely based on the advice of T. Bedford and B. McArdle of the scientific staff of the Medical Research Council, and of Surgeon Captain MacDonald Critchley and Surgeon Lieutenant-Commander H. E. Holling, who had carried out a survey of living and working conditions in the Mediterranean and Far East in 1943, was that an effective temperature of 80°F. [26.7°C.] constituted the upper desirable limit for working and living compartments, and that 86°F. [30°C.] effective temperature was the upper acceptable limit above which inefficiency would have to be accepted.

The effective temperature implies that the temperature of the walls and contents will be of the same order as the air-temperature of a compartment. When the mean radiant temperature of the surroundings is significantly greater than the air-temperature, as it may be in engine-rooms, it is important to make an allowance for the factor of radiant heat. To achieve this, globe-thermometer readings are substituted for the dry-bulb readings in the determination of the effective temperature, and the resultant figure is

termed the corrected effective temperature (Bedford, 1946). The upper desirable and acceptable limits of corrected effective temperature were again 80 [26.7°C.] and 86°F. [30°C.] respectively.

The cooling effect of air-movement on men stripped to the waist is very much greater than it is on men who are lightly but completely covered. Another scale of warmth, the Basic Effective Temperature Scale, constructed from observations made on men stripped to the waist, may be used for describing mess-deck conditions in the tropics where men are scantily dressed, and once more, the upper desirable basic effective temperature is 80°F. [26.7°C.] and the upper acceptable limit 86°F. [30°C.]. In this discussion, however, reference will be made only to the normal effective temperature scale, as men are always clothed in overalls at action stations, even in the tropics, as a measure of protection against flash burns.

It was now necessary to test the validity of this scale by psychological and physiological methods, and to determine the various combinations of thermal conditions at which men were likely to become partially or wholly inefficient in the performance of mental and physical work. Two series of experiments to this end were commenced at the Psychological Laboratory, Cambridge, and at the Medical Research Council Research Unit at the National Hospital in London. In these experiments, naval ratings were studied as they carried out mental and physical tasks, similar to those required of them aboard ship, in specially constructed chambers where the atmospheric thermal conditions were carefully controlled. The third line of attack was to make accurate measurements of the thermal environment, according to the effective temperature-scale in the working and living spaces of all classes of H.M. Ships in the Eastern Fleet which was then gathering at Trincomalee, and to observe any ill-effects of heat on the health or efficiency of the ships' companies.

### 2. Thermal Environment of the Men

It is to this third aspect of the problem that I would like to refer in greater detail, and to mention a few of the results which were obtained during a broad survey which was carried out towards the end of 1944 in 11 representative warships of the Eastern Fleet. In the assessment of the thermal conditions, the air-temperature and humidity were determined with the sling hygrometer, the degree of air-movement with a silvered katathermometer (cooling range 130-125°F. [54.4-51.7°C.]), and radiant heat, from hot machinery or sunbaked bulkheads, was expressed either in terms of the mean radiant temperature (calculated from the readings of the globe-thermometer, the dry-bulb temperature of the air, and the air velocity), or in terms of the corrected effective temperature.

The average thermal environment in these ships, based on a fairly large number of measurements, is seen to be ranged around the upper critical level at which it was thought that inefficiency due to excessive warmth might occur (table I). The average effective temperature in the living-spaces was 84°F. [28.9°C.], but in working-spaces, such as the engine-rooms, 88.7°F. [31.5°C.], in radar offices 86.9°F. [30.5°C.], and in the critical gun-control positions (high-angle calculating positions and transmitting stations) 86.5°F. [30.3°C.]. In certain compartments effective temperatures of the order of 91, 92 and 93°F. [32.8, 33.3 and 33.9°C.], were recorded, which constitute unacceptable conditions by any standards.

TABLE I. AVERAGE THERMAL ENVIRONMENT IN ELEVEN SHIPS OF THE EASTERN FLEET (1944)

	Compartment Conditions						Outside Conditions		
	Normal effective temperature (°F.) <sup>1</sup>	Dry-bulb temperature (°F.) <sup>1</sup>	Wet-bulb temperature (°F.) <sup>1</sup>	Air-movement (feet per minute) <sup>2</sup>	Absolute humidity (grains <sup>3</sup> per pound <sup>4</sup> of dry air)	Number of observations	Dry-bulb temperature (°F.) <sup>1</sup>	Wet-bulb temperature (°F.) <sup>1</sup>	Absolute humidity (grains <sup>3</sup> per pound <sup>4</sup> of dry air)
Mess-decks	84.0	90.0	82.0	100	151	947	83.1	76.6	128
Machinery-spaces	88.7	102.7	87.7	468	176	359	84.0	77.6	134
Gunnery-control positions	86.5	95.5	84.2	172	160	364	84.8	77.7	133
Gun-turret lower quarters	86.6	91.9	84.9	60	171	125	82.2	76.7	132
Radar offices	86.9	97.7	83.8	160	152	59	84.3	77.8	134
Electrical spaces	89.5	104.7	82.6	147	161	81	83.5	76.7	128
Workshops	87.5	100.3	83.7	193	149	55	83.7	76.7	128
Sickbays	83.0	90.9	82.1	239	155	82	84.1	78.1	138
Communication offices	85.8	95.9	83.9	163	156	168	84.4	77.6	132
Galleys	87.4	97.5	84.2	192	155	168	82.9	76.1	125

<sup>1</sup> [To convert F.° to C.°, subtract 32 and multiply by 5/9.—Ed.]<sup>2</sup> [1 foot = 30.5 cm.—Ed.]<sup>3</sup> [1 grain = 0.06 gram.—Ed.]<sup>4</sup> [1 pound = 0.45 kilogram.—Ed.]

There is insufficient space to discuss in detail the many problems arising from heat-radiation in machinery compartments, workshops, galleys and sometimes in radar offices, the greatly increased significance of the wet-bulb temperature in the tropics, or the importance of adequate air-movement in ensuring comfort. The mean radiant temperature of the surroundings was at times as much as 70°F. [21.1°C.] in excess of the air-temperature, and, in 30 % of the compartments where radiation was measured, lay between 120 and 150°F. [48.9 and 65.6°C.]. When ships were closed down at sea it was found that certain workshops, galleys and many positions in machinery compartments were untenable except for short periods. Corrected effective temperatures, ranging from 95 to 100°F. [35 to 37.8°C.] were not uncommon.

TABLE II. COMMON CAUSES OF ILL-HEALTH IN 28 SHIPS AND 6 NAVAL SHORE-ESTABLISHMENTS OF THE EASTERN FLEET, FEBRUARY TO OCTOBER, 1944

Rates per 100 man-months

Section of the community (man-months)	All skin diseases including boils but excluding prickly heat	Boils alone	Otitis externa	Dysentery and allied disorders	Minor injuries	Common cold
All operational ships (128,194)	9.19	2.64	1.84	2.31	3.8	1.45
Depot-ships (28,863)	10.96	2.64	3.01	4.08	5.99	2.02
Shore establishments (131,700)	5.75	0.82	0.99	1.83	2.09	1.1
All ships & shore establishments (288,757)	7.79	1.81	1.57	2.27	3.24	1.38

Total cases reporting at the sick-bay, comprising cases placed on either the sick-list or the attending-list.

### 3. Health of the Men

In order to examine the effect on the men of living in a hot wet environment, reports made by ships' medical officers in reply to a questionnaire on sickness were analyzed, and the results were expressed as rates per 100 man-months. Information is normally available of the numbers of men on the sick-list each quarter in each ship or establishment, but it was expected that a more important index of the health of the community would be afforded by the numbers who attended as outpatients with minor complaints.

For a five-month period during 1944 the average numbers reporting at the sick-bay every month varied between 30 (destroyers) and 40 (cruisers) per 100 men for the average ship's company. Only 3 to 6 men per 100 of these men were placed on the sick-list, and the remainder were treated as outpatients.

Skin diseases accounted for much ill-health (table II). Even when prickly heat, which was widely prevalent and affected 80 % to 90 % of men at one time or another, was excluded from consideration, it is seen that 9 out of every 100 men in operational ships reported at the sick-bay every month with skin trouble. Conditions were slightly worse in depot- and repair-ships which remained in harbour, but very much better in the shore establishments where the rate was practically halved. Boils alone caused

TABLE III. LESS-COMMON CAUSES OF ILL-HEALTH IN 28 SHIPS AND 6 NAVAL SHORE-ESTABLISHMENTS OF THE EASTERN FLEET, FEBRUARY TO OCTOBER, 1944

Rates per 100 man-months

Section of the community (man-months)	Heat exhaustion	Malaria	Common cold	Pulmonary tuberculosis	Neuro-psychiatric disease
All ships (157,057)	0.42	0.03	1.56	0.02	0.04
Shore-establishments (131,700)	0.04	0.76	1.17	0.02	0.11

Total cases reporting at the sick-bay, comprising cases placed on either the sick-list or the attending-list.



3 out of every 100 men to report sick each month. Thus, skin diseases dwarfed all other morbid conditions in importance. By no means all of the ratings affected reported sick, and so the true incidence is understated by these figures.

In comparison with the conditions shown above, malaria was relatively unimportant in the Eastern Fleet as a cause of manpower-wastage in ships (0.08) and also in shore establishments (0.76) (table III). The common cold (1.56), a diagnosis which covered a multitude of ills, probably caused more wastage than any of the fevers, if intestinal disorders are excluded. Overcrowding of the mess-decks had not increased the incidence of pulmonary tuberculosis (0.02) above the rate of 2 per 1000 per year, which has been reported by Dudley (1941) as the naval rate for 35 years before 1939, probably because ventilation-fans were operated at the maximum practical speeds, and up to 60% of the men slept on deck in camp-beds whenever they were able to do so. From these returns, neuropsychiatric illnesses (0.06) did not appear to be a serious source of trouble in ships, but, according to Cameron (1945), hospital experience at Trincomalee showed that 7% of all naval hospital admissions, a high figure, was due to psychiatric illness, and, furthermore, he considered heat to be an aggravating or causative factor in 48% of cases. The effects of extreme heat are indicated by a reported rate of 0.42 per 100 man-months for cases of heat exhaustion, or one man for every 240 men afloat each month. Again, many heat disorders falling short of true heat exhaustion were included under this heading.

Experience gained in analyzing this questionnaire led to the construction of a new monthly return from all ships reporting major and minor illnesses as recorded at midnight on Wednesday each week. I understand from Surgeon Commander Fraser Roberts, the Consultant in Medical Statistics to the Navy, that examination of the returns for the seven months, August, 1945, to February, 1946, inclusive, shows the rates for both major and minor illness in the Fleets in the East to be rather more than double those for ships in Home Waters.

The variable incidence of prickly heat in a cruiser and a battleship showed how widely the state of health varied in different ships. Inspections of ratings on the mess-decks before they turned in at about nine o'clock in the evening showed that in the battleship, out of an average number of 479 ratings who were examined when stripped to the waist, 26% had severe prickly heat of the upper body, and 33% had mild prickly heat. In the cruiser, on the other hand, only 2% of 337 ratings had mild prickly heat. The average environmental conditions on the mess-decks of these ships, which lay only a few cables<sup>5</sup> from each other, were of much the same order (effective temperatures 82.7 and 83.6°F. [28.2 and 28.7°C.] respectively), and it is believed that this marked difference in the incidence of prickly heat was because the cruiser spent more time at sea, had a better fresh-water supply, better mess-deck ventilation, and had recently visited temperate waters.

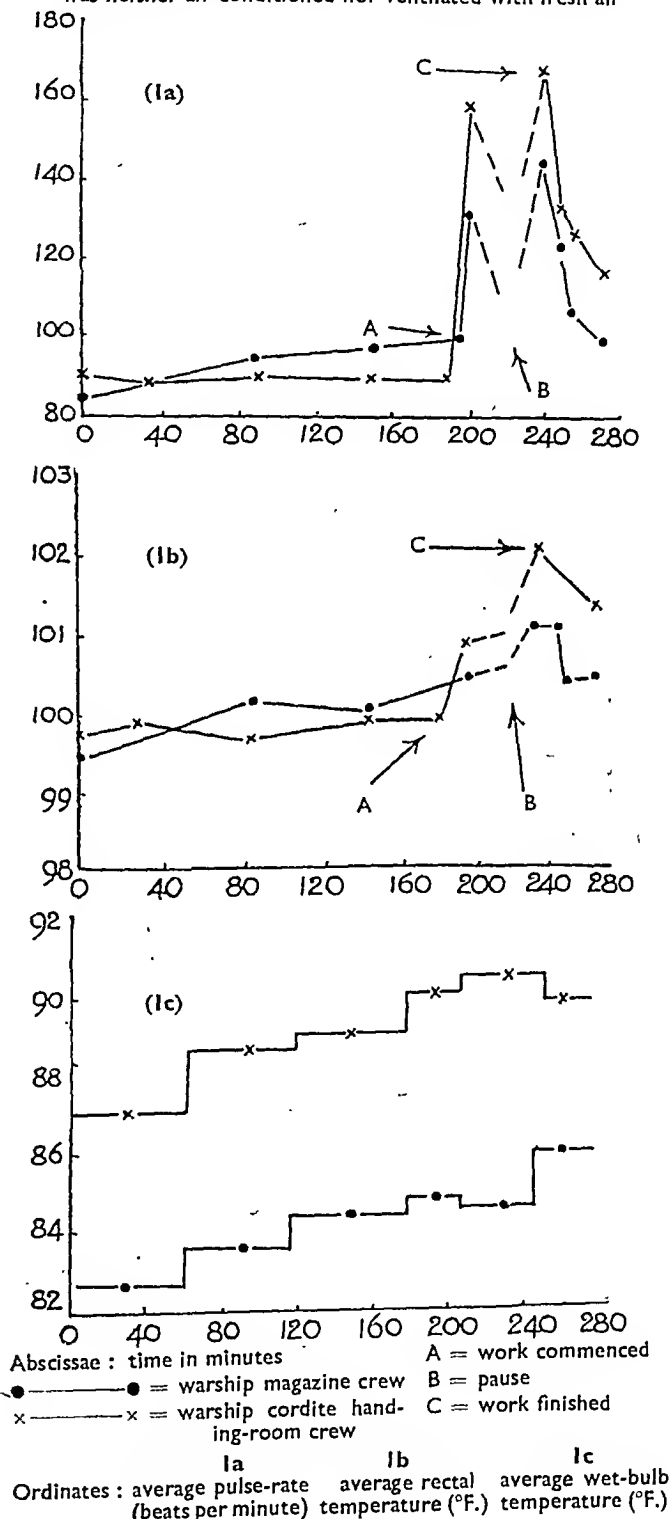
#### 4. Effect on Efficiency

Evidence of frank breakdown of efficiency was not easy to find. Authoritative opinion stated time and again that work took longer to do, and that the quality of the work was inferior to the standards attained in the Home Fleet.

There was some anxiety as to whether crews, handling heavy charges in the cordite-magazines and handing-rooms, at the bottom of the big gun-turrets in the battleships, would be able to maintain a satisfactory supply of ammunition

**FIG. 1. AVERAGE EFFECTS OF HEAVY WORK ON CREWS OF A GUN-TURRET MAGAZINE AND A CORDITE HANDING-ROOM IN THE TROPICS**

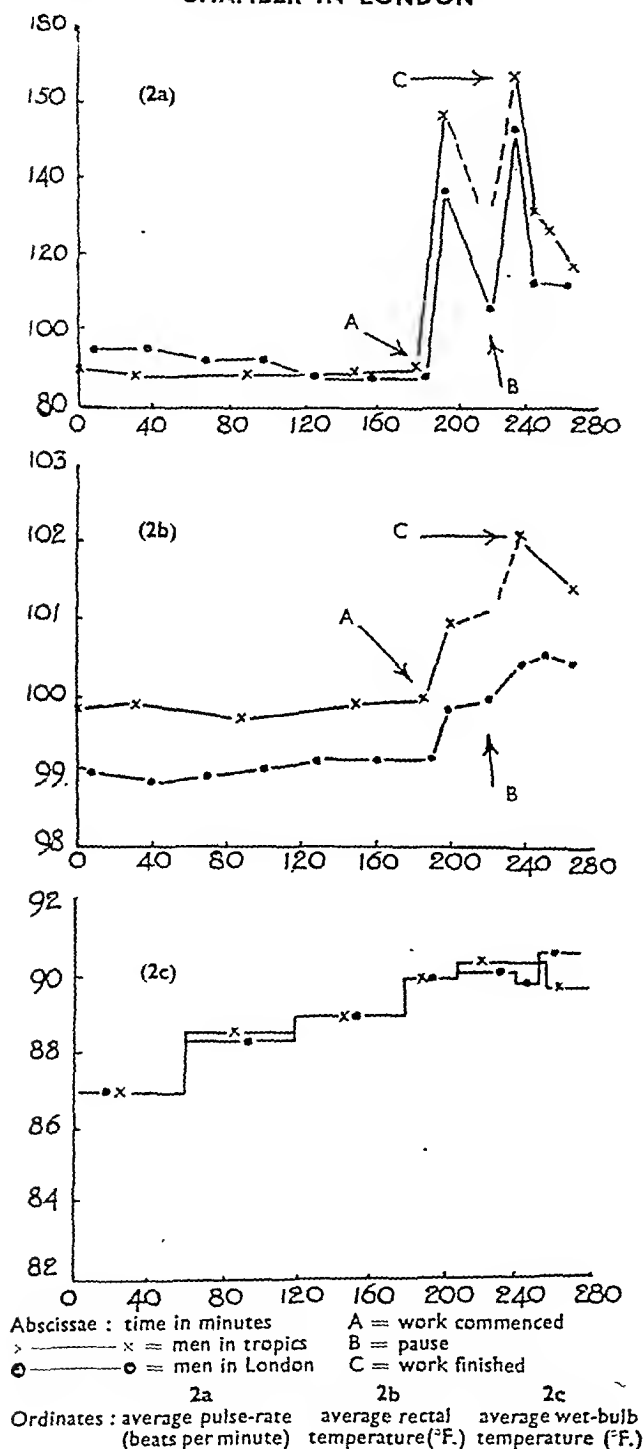
The magazine was air-conditioned. The cordite handing-room was neither air-conditioned nor ventilated with fresh air



<sup>5</sup> [1 cable = 182.9 m.—Ed.]

during a prolonged action, when the fresh-air ventilation to these compartments would be closed down in accordance with precautions to be taken against the danger of flash and flooding (fig. 1).

FIG. 2. AVERAGE EFFECTS OF HEAVY WORK ON THE ACCLIMATIZED CREW OF A CORDITE HANDING-ROOM IN THE TROPICS AND ON AN ARTIFICIALLY-ACCLIMATIZED CREW DOING SIMILAR WORK UNDER THE SAME THERMAL CONDITIONS IN A CLIMATIC CHAMBER IN LONDON



In order to examine this problem the magazine and cordite handing-room crews of a large gun-turret were closed up under action conditions off Trincomalee, and after a period of three hours' resting they carried out a typical loading-exercise, simulating the effort required in a moderately severe bombardment, and comprising two equal periods of hard work separated by a rest-pause. Measurements of rectal temperature, pulse-rate, blood-pressure, body-weight and fluid balance were made on the 6 hardest-worked members of the crew in each compartment. The air-supply to the magazine was recirculated through a freon cooling-machine which also extracted moisture from the air. The air in the cordite handing-room was neither cooled, nor recirculated, so that there was little air-movement. There was no fresh-air ventilation to either compartment. During the morning the wet-bulb temperature of the magazine rose from 82 to 86°F. [27.8 to 30°C.] (average effective temperature 85°F. [29.4°C.]), but in the cordite handing-room the wet-bulb temperature rose from 87 to 90°F. [30.6 to 32.2°C.] (average effective temperature 90°F.).

As a result of the violent exercise it is seen that the average body-temperatures (102.4°F. [39°C.]) and pulse-rates (166) of the cordite handing-room crew rose to much higher levels than those of the magazine crew (101.2°F. [38.4°C.] and 144), and several of the ratings were on the verge of collapse. There was no doubt that if the crew in the handing-room had remained closed up for many hours under the prevailing conditions they would not have been able to maintain the supply of ammunition for a satisfactory rate of fire. Conditions in the magazine were more acceptable but were still severe for such heavy work.

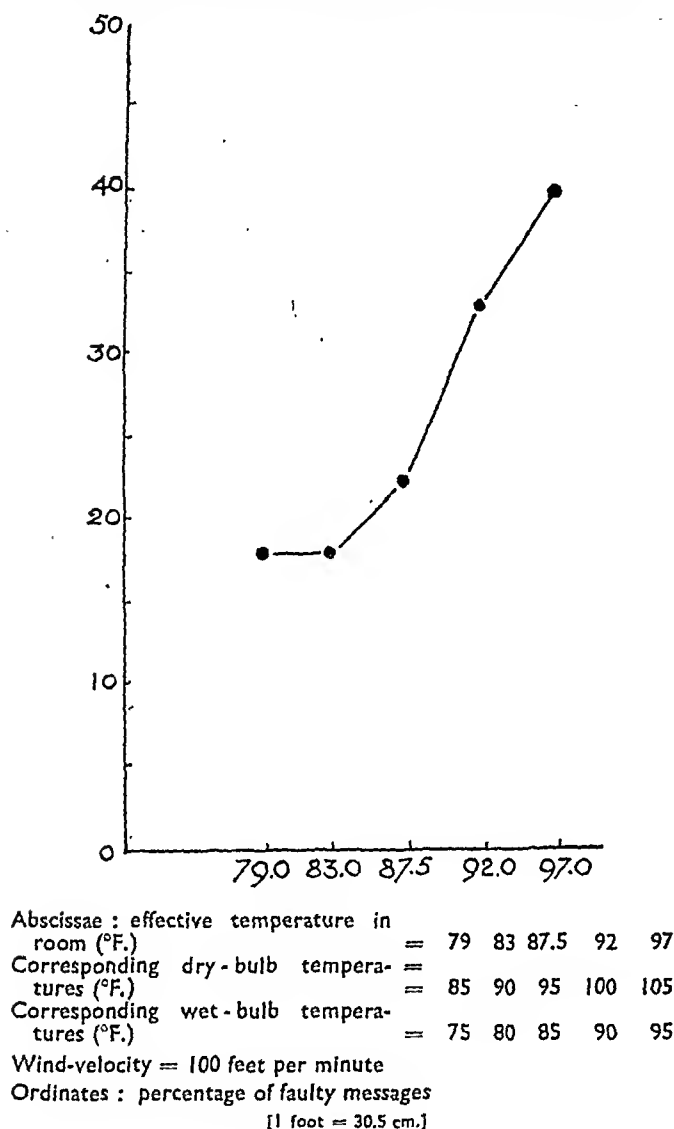
In this way information was obtained on which short-term policy could be based. Ventilation routines were adjusted to give a working compromise between the requirements of damage-control and the ensuring of an environment in which men could work efficiently. Minor structural modifications and alterations to improve local conditions were instituted, and data were obtained for formulating recommendations for the future.

Similar methods were also used in the machinery-spaces, and attempts were made to measure the deterioration of mental efficiency of men manning the gunnery-control positions.

It is of interest to see how the results obtained in the Fleet were correlated with the exhaustive studies made on the naval ratings at the National Hospital, London, and at Cambridge. McArdle and his colleagues (Benson, Colver, Ladell, McArdle & Scott, 1945) at the National Hospital repeated as closely as possible the cordite handing-room trial described above (fig. 2). The thermal conditions, shown here as wet-bulb temperatures, were practically identical during the trial with the conditions recorded in tropical waters. The men had been artificially acclimatized to heavy work of this type at high temperatures by daily exposure and wore tropical-action dress. It was found that the men working in Britain tolerated both the work and the warmth with less physiological disturbance than the men who were acclimatized to the tropics, because they were well trained for heavy work at high temperatures, whereas the men in the warship, although they lived in a tropical climate, worked in the excessive warmth of the cordite handing-room only at irregular intervals, and many of them had sedentary duties at other times.



**FIG. 3. EFFECT OF HOT CLIMATES ON WIRELESS-TELEGRAPHY OPERATORS HEARING AND RECORDING MORSE MESSAGES**



We have observed that the average effective temperatures in wireless and radar offices were approximately 86 and 87°F. [30 and 30.6°C.] respectively, and in some radar offices effective temperatures of 89 or 90°F. [31.7 or 32.2°C.] were repeatedly recorded. At Cambridge, Mackworth (1945; 1946) investigated the effect of heat on the efficiency of naval and Royal Air Force wireless-telegraphy operators working under similar conditions to those in ships (fig. 3). Efficiency was found to decline when the effective temperatures lay between 83°F. and 87.5°F. [28.3 and 30.8°C.], and declined rapidly at higher temperatures. There was considerable human variation (fig. 4), and it is seen that, whereas the competence of the average operator started to deteriorate above an effective temperature of 83°F., the very good operator could withstand extremely high temperatures and give a good performance.

Subjects carrying out the Clock Test for prolonged visual search, which simulates the psychological functions required of radar operators, and dressed only in shorts, reacted rather differently to the heat (fig. 5). The smallest number

of mistakes was made at an effective temperature of 79°F. [26.1°C.], with a significant increase in the numbers of errors in the warmer climate of 87.5°F. [30.8°C.]. It was also found that these lightly-clad men made more mistakes at an effective temperature of 70°F. [21.1°C.], than similarly-clad men working at 79°F. [26.1°C.]. Adverse effects upon efficiency are thus shown to be caused by chilling as well as by warmth.

The possibility must be borne in mind that conclusions reached from studies on men working for short periods each day in hot environments in Britain may not be applicable to fully-acclimatized men in the tropics. The information gained must be verified, therefore, by confirming the more important results in the tropics, and a laboratory is to be set up for this purpose in the near future.

**FIG. 4. EFFECT OF HOT CLIMATES ON WIRELESS-TELEGRAPHY OPERATORS HEARING AND RECORDING MORSE MESSAGES, SHOWING GROUP VARIATION IN PERFORMANCE**

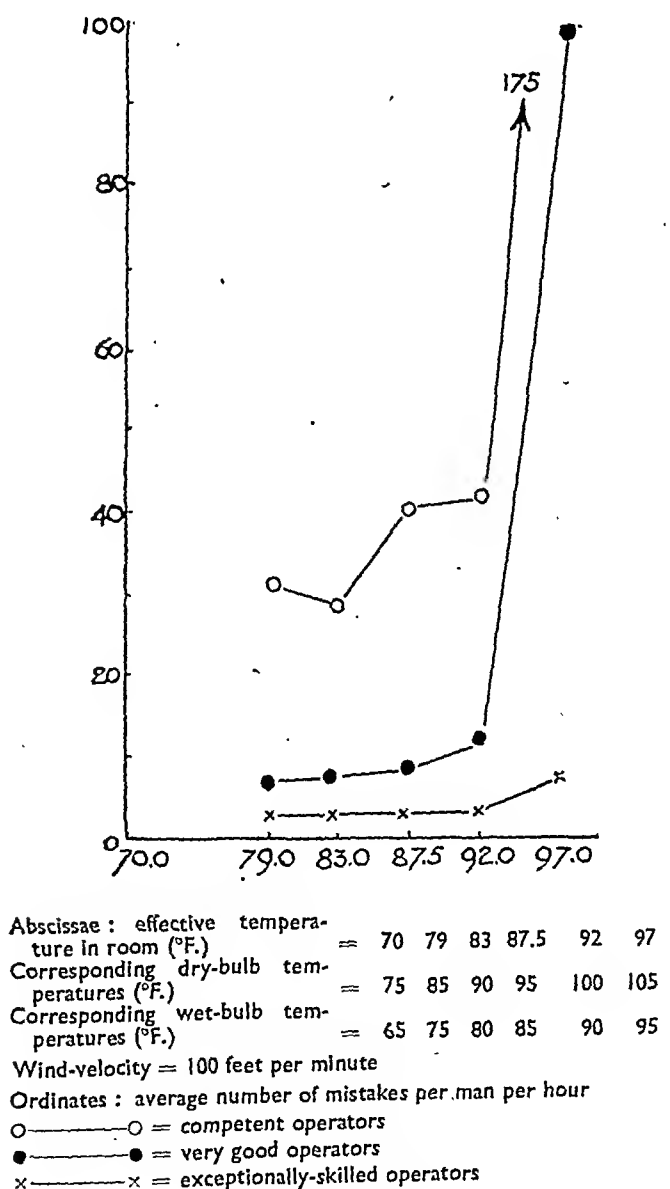
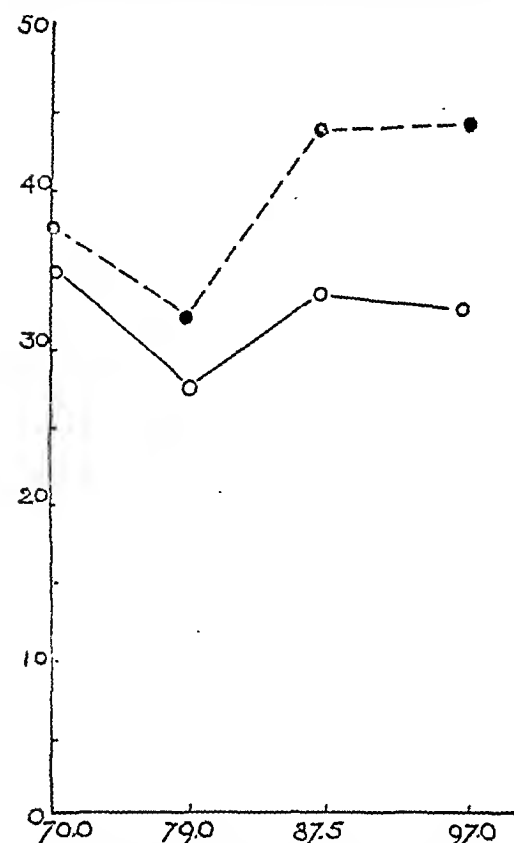


FIG. 5. CLOCK-TEST  
FOR PROLONGED VISUAL SEARCH  
AT DIFFERENT ROOM-TEMPERATURES,  
SHOWING INCIDENCE OF MISSED SIGNALS



Abcissae: effective temperature in room (°F.) = 70 79 87.5 97  
 Corresponding dry-bulb temperatures (°F.) = 75 85 95 105  
 Corresponding wet-bulb temperatures (°F.) = 65 75 85 95  
 Wind-velocity = 100 feet per minute  
 Ordinates: percentage of missed signals  
 ○ — ○ = first hour of test  
 ○ - - - ○ = second hour of test

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#### 5. Conclusion

We have briefly reviewed the thermal environment of the men in the Fleet in Eastern Waters under wartime conditions, the effect of climate on health, and some of the effects of heat on efficiency. The application of research in laboratories to provide answers to practical problems has been discussed. There has been no time to refer to problems of accommodation, fresh-water supplies, hygiene or catering, and to the importance of adequate general amenities and recreational facilities, but it is agreed that unless these requirements are fully implemented, efficiency will suffer and morale will deteriorate.

The visit to the Eastern Fleet had a practical as well as an academic side. A naval constructor, with an expert knowledge of ventilation and air-conditioning, was a member of the team, and he provided not only the engineering answers for improving unsatisfactory conditions, which enabled short-term improvements and modifications to be carried out, but, in addition, his technical knowledge was essential for a full appreciation of the situation. The importance of including a heating and ventilation engineer, and, if possible, a lighting expert, in any party surveying living and working conditions, whether ashore or afloat, cannot be stressed too forcibly.

The study of the effects of extremes of climate on efficiency and health are still in their early days in the Navy. The effects of excessive cold are largely unexplored. Enough information has, however, been gained in the last two years to show that the dividends paid by research more than justify the considerable efforts required.

#### ACKNOWLEDGEMENTS

I am indebted to the Royal Naval Personnel Research Committee of the Medical Research Council, for permission to publish this account of work carried out for the Committee.

My thanks are also due to Dr. Brian McArdle and his colleagues, and to Dr. N. H. Mackworth and Dr. K. Cameron, who have allowed me to refer to their unpublished reports.

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## BIOLOGICAL ASSESSMENT OF CLOTHING FOR TROPICAL SERVICE USE

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- 1 Assessment of heat-load of clothing
  - a Physical considerations
  - b Physiological test-methods
- 2 Mosquito-proofness
- 3 Physical properties of clothing and fabrics
- 4 Fabrics for action-rig and jungle-suits
- 5 Some features in design
- 6 Conclusion
- References

During the recent war a remarkable variety of clothing-problems affecting the efficiency of military personnel was brought forward for investigation. As is well known, many specialized garments and clothing-assemblies were required for the complex and often peculiar operations which characterized, for example, the Commando and other combined operations and reconnaissance raids, midget-submarine activities, and underwater demolition, apart from the frequently-changing requirements of the regular armed forces. The present paper deals only with the physiological problems encountered in providing action-rig and other protective clothing for use in tropical climates, and is based on the research activities of the wartime Climatic Unit<sup>1</sup> (National Hospital, Queen Square) of the Medical Research Council.

The clothing-problems investigated by the Unit for the Army in regard to jungle-warfare, for certain shore-personnel of the Navy, for combined operations and for the Fleet Air Arm, deep diving etc., had all in common the problem of assessing and reducing the heat-load to a degree commensurate with the desired operational requirements. In addition to the thermal properties of the clothing, a number of other factors had to be considered. The most important of these was the mosquito-proofness of fabrics, and this was regarded as a first priority in recommending fabrics suitable for use in action-rig and jungle-uniforms. A matter of interest to the Navy was that of "flash" protection; while attention had also to be given to resistance to tear and abrasion, and at different times to wetability, waterproofness and buoyancy. Apart from the particular properties of the fabric-construction there was the question of design. This was of prime importance in the specialized protective clothing for the uses already mentioned. In some cases the design was specified by the Service concerned,

and only minor modifications could be entertained; in others, as in the case of ventilated tank-suits, novel development-work was carried out.

It is not proposed in this paper to give a detailed description of these multifarious clothing-enquiries, but to use the results as far as possible for discussion of some of the more general findings, which may perhaps have a wider applicability. In particular, the methods used in assessing the thermal properties of clothing and mosquito-proofness merit some attention; while an outline of the fabric-properties and certain features of design suitable for tropical conditions may also be of some interest.

### 1. Assessment of Heat-Load of Clothing

#### a. Physical Considerations

The evaluation of the physiological role of clothing in a particular situation does not, in principle, involve any very difficult physical problems. In practice, however, and particularly when considering tropical climates, a very elaborate procedure is necessary for a complete analysis of the heat-exchange between the active clothed man and the environment. This is true even of the simpler cases where the subject is maintained in a steady condition of energy-output in a constant environment. Such studies, in which the function of the clothing as worn, in terms of its thermal properties—its thermal insulation, its resistance to moisture-diffusion, its surface-coefficients of loss of heat and water-vapour, or its effect on the "environment" at the skin-surface, have been carried out in the laboratory on small numbers of subjects and with very few types of clothing, and usually with the subject at rest (Winslow, Herrington & Gagge, 1938; Killick & Weiner, 1942, 1946; Ogden & Rees, 1946). A consideration of the thermal interchanges in such laboratory studies will indicate the main facts about the methods necessarily adopted in the studies of clothing and fabrics for military use.

In conditions approximating to "physiological" equilibrium, the change in heat-content undergone by the clothed body over a period of time may be expressed for the present purpose as the familiar heat-balance equation:

$$S = (M - W) - (E_r + E_e) \pm (C + R) \quad (1)$$

where  $S$  = rate of accumulation (positive or negative) of heat in the clothed body;

$M$  = rate of energy-output by the clothed subject;

$W$  = rate of energy-output appearing as external work;

$E_r$  = rate of heat-loss from the respiratory tract (most of this is evaporative heat-loss);

$E_e$  = rate of evaporative heat-loss from the body-surface;

$C$  = rate of heat-loss (or gain) by convection at the body-surface;

$R$  = rate of heat-loss (or gain) by radiation at the body-surface.

$(M - W)$  expresses the heat-production term;  $(E_r + E_e)$  the evaporative heat-loss and  $(C + R)$  the non-evaporative or "sensible" heat-loss.

In painstaking laboratory studies, all these separate components can be measured, and it is possible to achieve a complete partition of heat-loss into its various channels through the clothing and from the clothed surface to the surroundings. This requires a large number of measurements on every subject. For example, to assess the insulation-value of the clothing, the following relations need to be determined:

<sup>1</sup> The MRC workers concerned in tropical clothing research were E. A. Carmichael (Director), J. C. D. Hutchinson, W. S. S. Ladell, B. McArdle and J. S. Weiner.

$$I_{Cl} = \frac{T - T_a}{H} - I_a \quad (2)$$

where  $I_{Cl}$  = insulation-value of the clothing;  
 $I_a$  = insulation of the air at the particular wind-velocity;  
 $T_s$  = average skin-temperature of the subject;  
 $T_a$  = ambient air-temperature;  
 $H$  = heat-flow through the clothing =  $(C + R)$  in formula (1)

To obtain  $I_{Cl}$  it is necessary, therefore, to determine  $H$ , and therefore to measure the terms  $M$ ,  $W$ ,  $E$  and  $S$  in formula 1. The average temperature of the skin under the clothing needs also to be measured for the term in equation 2, and also, because it enters in the measurement of  $S$ , the change of heat-content of the body—a function of the change in mean temperature of the body, its mass, and its specific heat. The mean temperature ( $T_b$ ) of the body is obtained from the average skin-temperature  $T_s$  measured in at least a dozen spots, and from the internal temperature  $T_r$  measured in the rectum, according to Burton's (1935) formula:  $T_b = 0.33T_s + 0.67T_r$ .

The "ventility" of the clothing to passage of moisture-vapour may be expressed as a function of the pressure-gradient of water-vapour through the clothing, and of the rate of flow of water-vapour evaporated from the skin. The measurement of the vapour-pressures under the clothing presents some problems (Ogden & Rees, 1946; Killick & Weiner, 1946), while the "ventility" measurement itself is of limited value, since in most situations of military interest, the clothing becomes wet with unevaporated sweat, the clothes may stick to the skin-surface, and the effective evaporating surface may be that of the wet clothing. Exact measurement of evaporation from the sweating man ( $E_s$ ) by means of weight-loss requires, of course, an allowance for the absorbed water in his clothing, and also for other unevaporated moisture such as runs on to the floor, into his boots, etc. The difficulty of measuring the loss by "drip" often makes the measurement of evaporative loss quite inaccurate.

It is obvious that the more precise analysis of clothing-performance indicated in the foregoing, though carried out in a modified form on a few occasions by the MRC unit, does not lend itself to the assessment of large numbers of fabrics, or to comparisons on many subjects, as is so necessary in dealing with military problems. Laboratory studies are, in any case, marred by the difficulty of simulating important features of military conditions, where states of equilibrium both of the subject and the environment, and consequently of his clothing, are probably the exception rather than the rule.

#### b. Physiological Test-Methods

It is therefore not surprising that, in most of the clothing-tests, the procedure has to be greatly simplified, and only indirect estimates of the thermal properties can usually be made. The usual simplifications made in regard to the terms of the heat-balance equation (equation 1 above) are as follows. The heat-output term  $(H - W)$  is standardized throughout the tests at a level and in a sequence of work- and rest-bouts not too remote from actual conditions. The MRC unit found that stepping on and off a 1-foot-high<sup>2</sup> stool at various rates and for bouts of 5 minutes or more provided a satisfactory work-procedure. It required little practice, and many men could simultaneously perform it

in the hot-room. In this task, the energy-output as measured by the oxygen-consumption was maintained at levels of between 150 and 300 k. cal./hour, according to the circumstances. The standardization of the work-output permits the assumption that the loss of water from the respiratory tract ( $E_r$ ) remains constant in an experimental series. This is true in so far as the weight-load represented by the clothing and equipment varies very little. Adjustments can easily be made in this respect.

With the work- and heat-output standardized, the comparison between two or more items under constant conditions involves, in principle, only  $S$  and  $E$  in equation 1, since sensible heat ( $H_s$ ) is given by difference. The difficulties of measuring both  $S$  and  $E$  accurately have already been mentioned; the fact that  $S$  is only roughly obtained from change in rectal temperature is a limiting factor in all calculations of heat-loss factors in these experiments. Where the sweat-rate is so high as to make the measurements of unevaporated sweat unreliable because of "drip," an approximate value for  $E$  can be obtained by making sensible heat-loss  $(C + R)$  very small by carrying out the tests at a dry-bulb temperature of 95° or 96° F. i.e. near clothing-surface temperature. With  $(W - H)$  known and  $(C + R)$  regarded as a constant of small amount, and  $S$  calculated, an estimate of  $E$  can be made. This method has been used on occasion by the Unit.

The value of estimating  $E$  lies in being able to apply the index of "effective evaporation," i.e. the ratio of evaporated to total sweat-loss. In comparing tropical fabrics and in other situations, this index is of some use (the unclothed man may have an index of 70% or 80%, the clothed in some circumstances only 30% or 20% or less). The elimination of unmeasurable "drip," though useful is, however, not always possible.

By standardizing the conditions, an indirect comparison is therefore possible of the factors concerned in heat-loss from the body with different types of clothing and fabric. In the final resort, and for most military purposes, thermal study *per se* is reduced to a few easily-measurable criteria—the rectal temperature, the pulse-rate, the sweat-output, the water-uptake of the clothing and, as already mentioned, where possible, the evaporated and unevaporated fractions of the sweat-loss from the subject.

The measurement of rectal temperature is thus one of the main criteria used in clothing-tests. Its use depends also on the fact that much empirical work under controlled environmental conditions has indicated that the rectal temperature is raised proportionately to increased heat-load, whether due to increase of rate of work-output, or of load-carrying, or to changes in environmental conditions. Similarly, the pulse-rate of a particular individual bears a fairly close relation to heat-load factors.

The third important criterion, which has been extensively used, of the heat-load imposed by the clothing, is the rate of sweat-output and of unevaporated sweat-loss. The usefulness of these measurements has been established only as the type of work mentioned in this paper was continued, as well as by other hot-room work carried out by the MRC unit<sup>3</sup> (McArdle *et al.*, 1944-46). An increased sweat-output in some circumstances may partly be due to an increase in loss of evaporated water, but this factor can in most cases be measured, or allowance can be made for it.

<sup>2</sup> [1 foot = 30.5 cm.—Ed.]

<sup>3</sup> [See paper (BMB 1013) by W. S. S. Ladell in this number.—Ed.]

Where the "effective evaporation" is low, total sweat-loss appears to reflect differences in heat-load fairly reliably. More research on these and other points is still needed to establish the reliability of the simple criteria used in evaluating clothing.

The obvious utility of relatively simple measurements is that they allow a more adequate statistical control of the experiment and more variables can be given due consideration. This is of importance in clothing-experiments where other effects, such as individual differences or interaction between clothing, climates, persons and other factors, may produce effects of a magnitude comparable to that of the clothing itself.

It is also of some importance before making clothing-tests to carry out a full regime of acclimatization of the subject to the worst conditions of heat, clothing and work to be encountered in the actual tests. This requires at least two weeks of successive daily exposures (excluding Sundays) of 3 or 4 hours at least. As repeated exposure affects all the main criteria used in evaluating clothing, particularly the sweat-rate (McArdle and Weiner, quoted by Ladell, 1945) and individual differences are very great both in rate and magnitude of acclimatization (Robinson, Turrell, Belding & Horvath, 1943; Taylor, Henschel & Keys, 1943), acclimatization to the actual experimental conditions is essential. Full hydration of the subject is also usually practised.

## 2. Mosquito-Proofness

As the provision of mosquito-resistant fabrics was a requirement for many types of military protective clothing, methods for testing mosquito-proofness had to be devised. The "biological" test, on which main reliance was placed, was that of Sir Rickard Christophers, and was carried out at the Molteno Institute, Cambridge. This test involved exposing an area of the arm, covered by the fabric, to the bites of 200 starved *Aedes aegypti*. The number of wheals in 15 minutes was noted.

As the Unit was asked to decide on the probable mosquito-proofness of a large number of fabrics (over 60 eventually) in relation to thermal features, a rapid preliminary method was essential to differentiate at least between fabrics which were definitely mosquito-proof and those that were certainly not. A "photographic" method was devised, and consisted merely of staining a 2-inch [5 cm.] square of the fabric with an opaque dye, such as fuchsin, placing it in front of a light-source, and photographing it. This test placed fabrics into one of three categories: (i) those showing no light-penetration when stained, and which were regarded as mosquito-proof; (ii) those which showed a very few fine pinpoints of light; (iii) those which showed some fine or large light-areas and were regarded as definitely penetrable by mosquitoes.

The results of the photographic method were always subject to confirmation by the biological test. Results on 57 fabrics by both methods are available; table I shows the fabrics grouped into three classes according to each of the two methods.

It can be seen that, for discriminating between the most useful and the least useful fabrics, the photographic test is

TABLE I. BIOLOGICAL AND PHOTOGRAPHIC TESTS OF MOSQUITO-RESISTANCE OF FABRICS

Biological test		Photographic test		
Degree of mosquito-resistance	Number of fabrics	Impenetrable (no light-area)	Penetrable with difficulty (very few fine points of light)	Definitely penetrable (some fine or large areas of light)
Impenetrable ... (0 wheals)	20	19	1	0
Penetrable with difficulty ... (0-5 wheals)	9	1	6	2
Definitely penetrable ... (5 or more wheals)	28	0	8	20

of definite value, and for differentiating between 2 classes—impenetrable and penetrable—the results are very satisfactory.

## 3. Physical Properties of Clothing and Fabrics

The physical characteristics of fabrics and clothing which are relevant to physiological performance in the tropics are the thickness, the weight per unit-area, the water-vapour resistance ("ventility"), air-permeability, water-absorption and "drying out," and the construction of the cloth. Standardized tests of these qualities have been devised by the Cotton and Wool Research Associations, with whom close contact was maintained by the MRC unit.

The thermal resistance of fabrics is dependent on the thickness irrespective of the fibre used (Rees, 1941) when measured under standardized conditions of pressure, relative humidity and windspeed. Physiological testing of fabrics has shown that increase in thickness of cloth imposes an increased heat-load as indicated, for example, by an increase in sweat-loss. Evidence is also available of the greater heat-load imposed by heavier fabrics, allowing for the effect of fabric-thickness. The relation of air-permeability to physiological effects is discussed below. The water-holding properties of a fabric, as measured by standard textile methods, are of use in indicating the probable uptake of sweat in the different layers of clothing, particularly if the fabric is found to be highly water-repellent. Details of the construction of the fabric are of interest not only in relation to thermal properties, but also to mosquito-proofness, since it is likely that the number of counts in the warp and weft are related to mosquito-resistance.

It may be said that far more systematic investigation of the relation between physical characters (particularly water-vapour permeability and water-holding properties) and physiological performance is still required, since most of the available results have been obtained, in Britain or in USA—notably by Robinson (Robinson *et al.*, 1943)—mainly during the course of *ad hoc* testing.

#### 4. Fabrics for Action-Rig and Jungle-Suits

As the bush-shirt fabric (british cellular cloth) of the army tropical uniform is of an open construction and easily penetrable by mosquitoes, it was decided to substitute a fabric which would be mosquito-proof but which would not impose any greater heat-load than the bush-shirt and drill trousers of the usual army uniform. The effect of rendering the clothing water-repellent was one of the questions on which information was also sought. The Unit was asked, therefore, to recommend a suitable and readily-available fabric, and to investigate the particular factors governing the choice of suitable fabrics. It may be added that the United States Army insisted on mosquito-resistance as a first priority, and at the present time it still remains a requirement as a protective measure against both malaria and dengue.

For comparison with the cellular fabric of the army uniform there were available, at the time, only seven fabrics which, from their physical characters and availability, could be considered as possible substitutes for the army cellular-weave fabric or for the naval overall fabric, whose replacement was also under consideration. As shown in table II, with the exception of L 30 (an experimental type of cloth) the possible fabrics were both lighter and thinner than the cellular bush-shirt, and they were all (with one exception) impenetrable to mosquitoes. The physiological tests were therefore undertaken to discover whether the lighter and thinner fabrics would not, in fact, impose a greater heat-load in view of their greatly-reduced air-permeability.

The methods used have been described above. Fully acclimatized subjects wore suits (bush-shirt and trousers) made of the test-fabric and of identical size and pattern, together with full battle equipment. They carried out step-climbing work with rest-pauses, the energy-production over the two-hour test-period being somewhat less than that of marching at  $2\frac{1}{2}$  miles<sup>4</sup> per hour. The tests were

done in "still" air-conditions, dry-bulb temperature 95° F. [35° C.], wet-bulb 85° F. [29.4° C.], air-movement less than 30 feet [9 m.] per minute, and also (with fewer suits) in a 10-miles-per-hour wind at a dry-bulb of 98° F. [36.7° C.], wet-bulb 84° F. [28.9° C.]. At these dry-bulb temperatures, heat-loss by radiation and convection was at a minimum. The metabolic heat could be partitioned into (a) heat retained in the body (S), and (b) heat-loss by evaporation (E) by applying equation (1) discussed previously. S was calculated from the rise in rectal temperature, and the body-weight, specific heat, and metabolic heat being known. E could be calculated. The value for E expressed as a percentage of the total sweat-loss gave a figure for "effective evaporation" as one criterion of the heat-load, the other criteria being the rectal temperature and the total sweat-loss.

The results shown in the table indicate little or no physiological difference between the fabrics; even in the 10 miles/hour wind, the "utility" gabardine (air-permeability about 12 feet<sup>3</sup>/foot<sup>2</sup>/minute) is little different from the cellular weave (air-permeability 40 foot<sup>3</sup>/foot<sup>2</sup> per minute). American workers have confirmed this finding in a comparison of the US poplin (air-permeability 4 foot<sup>3</sup>/foot<sup>2</sup> per minute) with the cellular weave. In general, where fabrics suitable for tropical military clothing are concerned, especially in the case of thin, light mosquito-proof fabrics, it appears that a very low air-permeability does not adversely affect heat-loss. The tests done in Britain, and in America by Robinson (Robinson *et al.*, 1943), show also in general that the lighter and thinner the fabric the less the heat-load, though the differences are small. The effect of rendering fabrics water-repellent was not noticeable by physiological criteria in prolonged tests, but subjectively such fabrics are found to be quite definitely unpleasant. Against the slower and smaller uptake of moisture by the treated clothing, must be balanced the increased water-content of the underclothes, socks and boots.

The fabric recommended by the MRC unit for hot wet climate was "utility" gabardine 3170, non-water-repellent. This is a twill fabric which is not difficult to obtain.

TABLE II. COMPARATIVE TESTS OF HEAT-LOAD OF VARIOUS FABRICS

Fabric	Weight (ounces/yard) <sup>5</sup>	Thickness (1/1000 inch) <sup>6</sup>	Still air			Wind 10 miles/hour		
			Sweat-loss (grams)	Temperature rise (°F.) <sup>7</sup>	Effective evaporation (%)	Sweat-loss (grams)	Temperature rise (°F.) <sup>7</sup>	Effective evaporation (%)
British cellular	7.97	30	1,787	2.44	29	1,360	0.95	45
"Utility" gabardine	5.21	16	1,730	2.37	32	1,354	0.85	46
US poplin	7.25	16	1,729	2.65	31	-	-	-
Naval twill	7.11	19	1,777	2.50	30	1,379	1.03	45
L 24	6.10	14	1,790	2.30	31	-	-	-
L 30	9.15	21	1,800	2.41	29	-	-	-
No. 2† drill	6.92	25	1,862	2.69	28	-	-	-

† Penetrable to mosquitoes with difficulty.

<sup>4</sup> [1 mile = 1.609 km.—Ed.]

<sup>5</sup> [1 ounce = 28 g.]

<sup>6</sup> [1 yard = 0.9 m.—Ed.]

<sup>7</sup> [1/1000 inch = 0.0254 mm.—Ed.]

<sup>8</sup> [To convert °F. to °C. subtract 32 and multiply by 5/9.—Ed.]

#### 5. Some Features in Design

As mentioned at the outset, the clothing-assemblies investigated by the Unit, apart from regular military clothing, were often of a specialized kind. Some of these required the wearer to operate in climates of a wet-bulb temperature near 80° F. [26.7° C.], in bulky and quite heavy clothing made of fabrics impermeable to air, and in some cases the head was enclosed within a helmet.

In such situations, it was often necessary to stipulate the limiting environmental conditions in which the man could be expected to perform his task, and also to attempt modifications of the design to reduce the heat-load. The two most useful measures usually explored in such

cases were: (i) wetting the outside of the clothing and thus maintaining the surface-temperature of the clothing-assembly near to the wet-bulb temperature of the air; (ii) the possibility of blowing in a relatively-large volume of outside air or a smaller volume of conditioned air, i.e.

air either cooled or dried; (iii) a combination of both.

The first measure, simple as it is, often produces quite marked improvement, as shown some years ago in the case of gas-protective clothing by Crowden (1938). The fact that, in certain military operations, the protective clothing could be wetted in the sea, was in some cases the main circumstance making its use possible in conditions of high dry-bulb temperature and solar radiation.

The second method is applicable, of course, only where a blower, and if necessary a refrigeration-unit or a supply of dry air, are available; the provision by these means of a "micro-climate" under the clothing, which prevents the rectal temperature rising above, say, 99.5° F. [37.5° C.], may often require only a small quantity of ambient air, providing that it is fairly well distributed under the clothes and the wearer does not perform excessive work.

Some experiments from a number carried out by J. C. D. Hutchinson may be quoted to illustrate the effects of these procedures. The suit was totally impermeable to water-vapour, and the wearer performed light work. Table III makes clear the difference in heat-load as a result of treating the suit as described, using the physiological criteria already discussed. Air movement was "still"—about 50 feet/min.

A problem encountered not infrequently is the case where clothing which may be comfortable in the tropics in one situation may quickly become too cool in another set of circumstances. Thus, clothing may be too cold for prolonged immersion in a tropical sea at night, while quite suitable ashore; or clothing suitable for the water may be too hot for hard work ashore, even if wetted. Similarly, in the RAF, pilot's clothing before flight may be quite uncomfortable, especially with high radiant-temperatures from the surroundings, and yet not be warm enough when flying. The obvious expedient of ventilating the clothing with cool or warm air as necessary illustrates the paradoxical situations that one may encounter in the tropics.

TABLE III. EFFECT OF WETTING OR VENTILATING PROTECTIVE CLOTHING WORN AT HIGH WET-BULB TEMPERATURES

Environment		Treatment given to suit	Sweat-loss (cm. <sup>2</sup> /min.)	Maximum rectal temperature (°F.)	Sweat in under-clothes (cm. <sup>2</sup> )	Pulse-rate taken standing after light work
Dry-bulb temperature (°F.)	Wet-bulb temperature (°F.)					
90.0	82.0	dry	6.33	99.3	400	94
		wetted	2.28	98.9	120	84
		wetted and with blower	1.37	98.8	94	84
100.0	87.0	dry	11.0	100.0	608	107
		wetted	9.1	99.8	606	93
		wetted and with blower	6.4	99.3	250	89

## 6. Conclusion

From the war-time *ad hoc* work of the Medical Research Council Climatic Unit, in dealing with military clothing-problems, outlined above, the main features of physiological testing of tropical clothing may be fairly well illustrated. The methods necessary in principle and in practice for the assessment of the heat-load have been discussed, and certain of the more important fabric-properties, particularly that of mosquito-proofness, are described. Consideration is given also to certain devices used in dealing with the excess heat-load of specialized clothing-assemblies.

## ACKNOWLEDGEMENTS

The author's acknowledgements are due to Dr. E. A. Carmichael, C.B.E., for permission to quote from the work of the MRC unit.

The investigations mentioned were made possible by the co-operation of the officers and men of the army and navy in very arduous experiments.

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# ANTHROPOMETRIC PROBLEMS IN THE ROYAL AIR FORCE

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- 1 Body-measurements
- 2 Measurements of man and machine
- 3 Information on the physical development of the population derived from measurements of heights and weights
- 4 Body-measurements and crew-duties
- 5 Age-curves for height and weight
- 6 Other applications of anthropometric research

Body-measurements are of various kinds, and knowledge of their variation for groups of men may be of military significance in various ways. The questions to which such knowledge is applied can be divided into two groups according to whether they are of medical interest, or whether they concern matters which are not of a medical nature. During the war, anthropometric research carried out in the Medical Directorate of the Air Ministry was concerned chiefly with non-medical problems. This was so because workers at the former RAF Physiology Laboratory, now the RAF Institute of Aviation Medicine, were charged with promoting the safety, welfare and efficiency of all flying personnel in the Service from a general, as well as from a medical, point of view. Such matters concern selection on medical grounds, the maintenance of physical fitness, an examination of the physiological effect of the exceptional conditions to which airmen may be exposed. They also involve consideration of more mundane questions, such as the design and fitting of the special clothes and personal equipment worn by aircrew, the lay-out and dimensions of the restricted spaces in which they must be able to operate with comfort, and means of rapid escape from aircraft in emergencies.

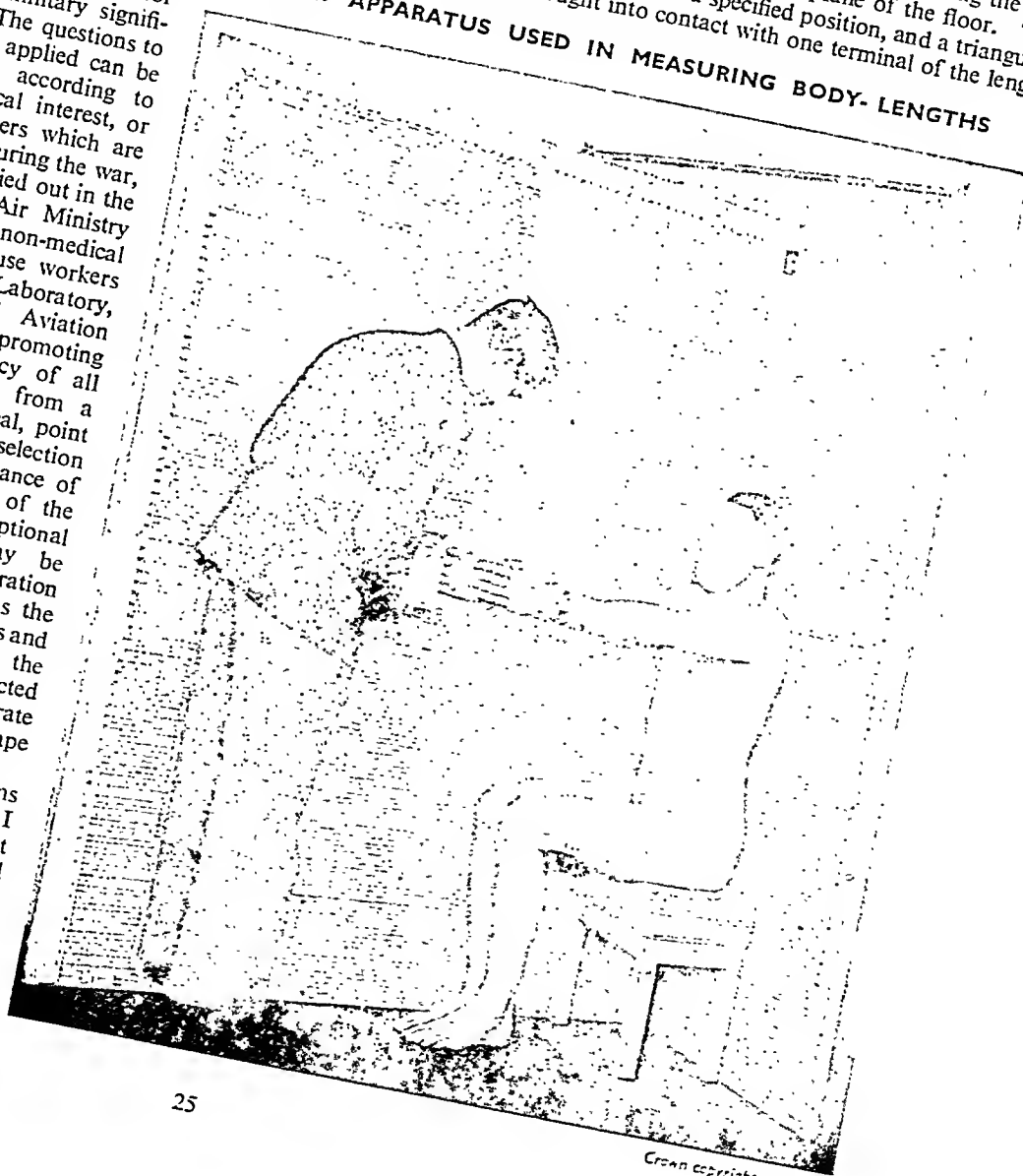
There was no lack of practical problems relating to body-dimensions of aircrew. I was occupied with them during the last year of the war under the general direction of Air-Marshal Sir Harold Whittingham, who was Director-General of the Medical Services of the Air Ministry at the time. The first need was for information regarding variation in the

body-measurements of aircrew. This was obtained from several sources. Two surveys providing the measurements required were carried out. One was of 2,400 recruits for flying duties, and another, undertaken primarily to obtain information required for sizing clothing, was of 520 flying personnel in training. The measurements taken were of an unusual kind designed to assess the space occupied by the body in different positions, rather than the proportions of its anatomical parts.

## 1. Body-Measurements

Length-measurements such as stature, sitting height, the lengths of the arms and legs, and so on, were taken with the aid of the measuring board shown in fig. 1. The two wings of it are fixed so that they are perpendicular to one another. Horizontal and vertical scales with half-inch [1.27 cm.] intervals are marked on them, the origins being the line where the two wings meet and the plane of the floor. The subject sits, or stands, in a specified position, and a triangular block is brought into contact with one terminal of the length

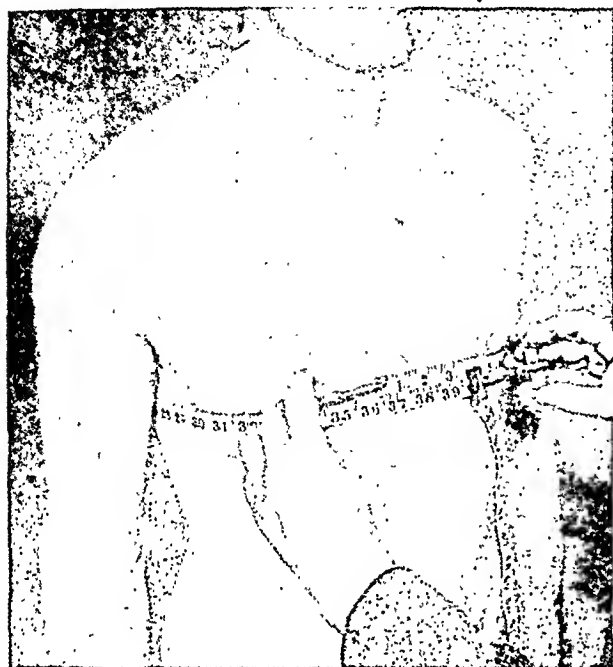
FIG. 1. APPARATUS USED IN MEASURING BODY-LENGTHS



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**FIG. 2. MEASUREMENT OF CHEST-GIRTH WITH A CONSTANT-PRESSURE TAPE**



required. The length is then read directly, as a projective measurement, on the appropriate scale of the board. The method is speedy in use and it gives more accurate measurements than any method depending on the location of skeletal "points" by palpation.

In finding body-girths, a constant-pressure tape was used (fig. 2). It was devised by my colleague Squadron-Leader J. C. Gilson. There are two attachments with springs in them fastened to the tape, and a reading is taken when the tension is sufficient to bring pointers to marked positions. This device makes the recording of body-girth easy and rapid. Use of the constant-pressure tape instead of an ordinary tape reduces the personal equation in measuring, say, chest-girth, very considerably, so that more consistent and more accurate readings are obtained.

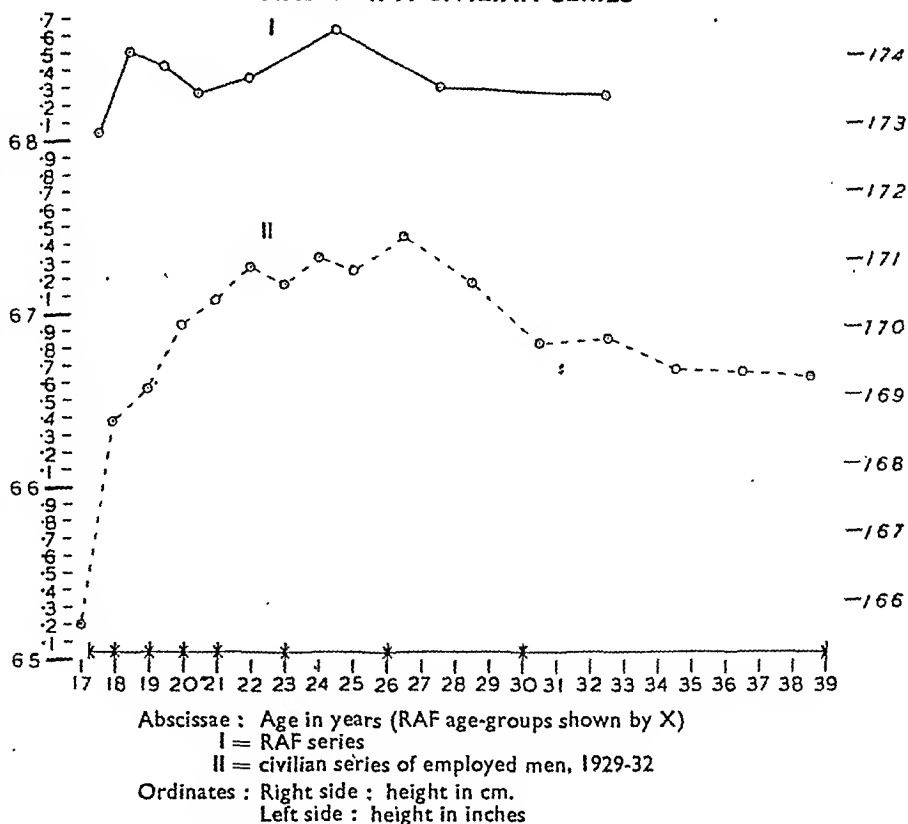
Detailed body-measurements taken in such ways could be found—and were really required—only for a comparatively small sample of the total population of all RAF flying personnel, but heights and weights were available for much larger numbers of the men. For purposes of control, height and weight happen to be the best pair of measurements that could be chosen. Body-lengths—such as those of the trunk, arms and legs—can be predicted most accurately from height, while girths of the trunk and limbs can be predicted better from weight than from any single girth or other measurement.

These data provided the essential basic knowledge required in dealing with problems associating a number of men of various sizes and shapes with spaces in which they have to operate, or with clothes or special equipment they have to wear. After the data had been reduced, the measurements could provide an answer to a question of this kind: if pilots were more stringently selected on account of size—if all less than 67 inches [170 cm.] in height were excluded, for example—what would be the distributions of other measurements, such as arm-length and leg-length, for the selected group?

## 2. Measurements of Man and Machine

But many practical problems dependent chiefly on variation in body-size could not be answered without obtaining further information. The body-measurements available relate to static bodies. A fighter-pilot in flight, say, has to be constantly moving his arms and legs to operate controls, and his head and body to scan instruments and his surroundings. By themselves, the body-measurements cannot give any precise answer to the question of what the major dimensions of a cockpit should be and of where the controls can best be placed. It is clear, too, that the body-measurements alone cannot tell what the best shape and dimensions are for an escape-hatch in a bomber when the aircraft-designer requires the hatch to be as small as possible. Or another factor may be involved, such as strength and endurance of the legs which will depend on the position of the body and other conditions.

**FIG. 3. AVERAGE HEIGHTS AT DIFFERENT AGES FOR 2,400 RAF AIRCREW RECRUITS AND FOR A CIVILIAN SERIES**



Such problems concern bodies functioning in particular ways. They can be investigated satisfactorily only by carrying out experimental investigations. In a particular case, an experimenter has to be arranged reproducing the conditions of the problem, and observations have to be taken on a number of subjects. Their size will be one of the factors involved, and hence it is necessary to measure them. By relating the body-measurements of the subjects to those available for the total group considered—which may be all flying personnel, or pilots only, or air-gunners only—it is possible to obtain conclusions for that total group. Such questions are too specialized to be of general interest, and usually there are no medical considerations relevant to them. However, the extensive records of the heights and weights may at least be of indirect medical interest.

### 3. Information on the Physical Development of the Population Derived from Measurements of Heights and Weights

Fig. 3 shows average heights at different ages for 2,400 accepted candidates for flying duties measured in 1942, and for a larger civilian series measured before the war. No doubts of height were applied to the aircrew-recruits, and the fact that they are taller at all ages than the "employed men" may be attributed to medical and social selection. From records collected at various dates, it has been found that there are appreciable differences between the average heights of series of men representing different social classes. A more interesting point is that the aircrew-recruits aged 18 had an average height as great as that for any later ages. Actually there are no statistically-significant differences between the means for any age-group from 18 onwards. The situation has been found to be the same for other series of flying personnel and for ground-staff, these records being for a total of about 30,000 men. For every series the average height is found to be as great for age 18 as for later ages. To anyone familiar with the records of heights of British men in pre-war years this must appear to be a remarkable fact. All the earlier series representing the British population in general which are long enough to provide good statistical evidence give average heights showing appreciable increases up to some age between about 23 and 25 years. The civilian series in fig. 3 actually shows the greatest average for age 26, but the maximum had almost been reached by age 22. This is quite a marked difference from the attainment of maximum height at age 18 found for the RAF series.

It may be suggested that, owing to the way they are selected, a group of men accepted for one of the fighting Services may give a distorted picture of an age-curve. But this had not been suspected previously, and there are no height limitations applied to recruits in general in Britain. The heights of 200,000 recruits reported after the war of 1914-18 show a maximum average at age 25. In fact there seems to be no reason why the conclusion that maximum height is normally reached at age 18 to-day should not be supposed true for the total male British population. If this be accepted, then there is good evidence to show that skeletal maturity is now attained normally some five years earlier than it was a few decades ago.

During the twenty years between the two wars, much attention was paid to growth in children. It was shown repeatedly that, at any particular age, they were becoming decidedly taller and heavier on the average. Controlled

experiments showed that the more rapid growth of the children could be attributed, partly at least, to improved nutrition, which might take the form of additional milk. It was commonly stated that British people in general were increasing in size owing to better feeding, the implication being that when they were fully grown the children who were growing up more quickly would be larger, on the average, than their parents. In fact there was no good direct evidence favouring that contention, because there were no good series of measurements of heights and weights for ages between 17 and 25 years. Nearly all the series were for ages below 17. That gap is now filled by records collected during the war. For RAF ground-staff the average height without boots is close to 67.7 inches [172 cm.], and for the more stringently selected aircrew it is nearly an inch [2.54 cm.] greater. Making a slight allowance for the effect of selection on medical grounds, it is reasonable to conclude that for the total British adult male population the average stature to-day must be close to 67.5 inches [171.4 cm.]. Records collected during the war for large numbers of men in the army and for civilians suggest that this estimate must be close to the true value.

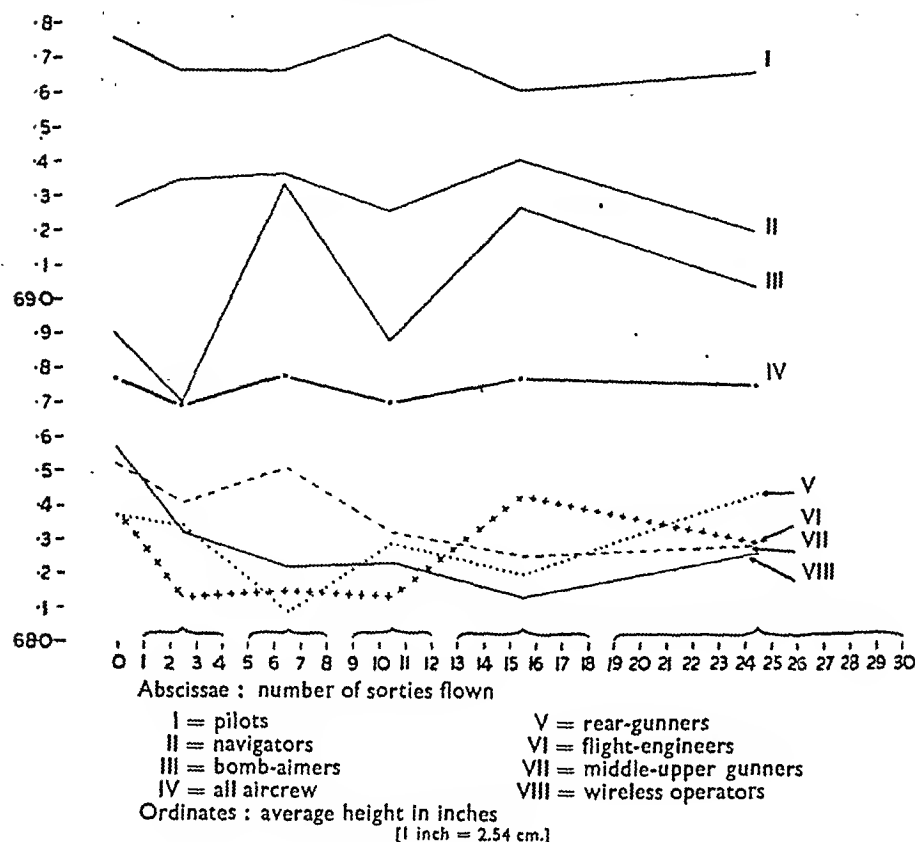
Fig. 3 shows that the series of employed men for ages 22 and over had an average height about 67 inches, but there is reason to believe that, for the general population about 1930, the average must have been nearer to 67.5 inches. Surveys carried out in earlier years back to about 1860 lead to the same conclusion, and there is no good evidence for the earlier times. In the past 75 years the average stature of British men seems to have remained remarkably constant, and there is certainly no clear indication of any secular increase in recent years. There has been a decided change in the age at which skeletal maturity is reached and this is an interesting point. We have been growing up more quickly without becoming larger when fully grown. Before long we may know whether the secular change in the growth-rate which was manifested between the two wars was maintained throughout the second war, or whether conditions then reversed the process.

### 4. Body-Measurements and Crew-Duties

Fig. 4 is based on measurements of 8,000 personnel who were operating in Bomber Command in April, 1944. Average heights are shown for crew-duties separately and, for each crew-duty, points are given for different series distinguished by the number of sorties flown by the men. There is seen to be a clear separation of the crew-duties. This is partly due to deliberate selection for height applied when the men were allocated to particular duties. There was a minimum height-limit of 64 inches [162.6 cm.] for pilots and a maximum height-limit of 72 inches [182.9 cm.] for air-gunners. Otherwise the crew-duties were not selected on account of body-size.

The clear stratification, as it were, of the average heights for crew-duties, other than those of pilot and air-gunner, may be attributed to a process of selection not directly involving height. Starting with a group of recruits accepted for aircrew training, those who were to become pilots, navigators, and bomb-aimers were selected first. On the average, these would be the better-educated, so the sorting-out gave a separation something like that between social classes, which are known to be distinguished by average heights.

FIG. 4. AVERAGE HEIGHTS FOR DIFFERENT CREW-DUTIES (BOMBER COMMAND) RELATED TO THE NUMBER OF SORTIES FLOWN BY THE MEN



Heights of series for groups of men who had flown different numbers of sorties were examined for a particular purpose. If either extremely large or extremely small men had been so handicapped in performing their duties that their chance of survival was less than that for men of normal size, then this might have resulted in the distributions of heights being slightly different for airmen starting operations and for veterans. In fact, no suggestion was found, judging from the measurements of heights for large numbers of aircrew, that body-size was in any way related to the chance of survival. It can be seen from the diagram that there is no suggestion of a trend towards either increase or decrease in the average heights for any crew-duty with increase in the number of sorties flown.

Heights were involved in another enquiry concerning a particular type of aircraft. It was suspected that small pilots were at a disadvantage in operating this type because it was rather more difficult for them to manipulate its controls. The heights were obtained of a number of pilots who had had accidents while flying the aircraft in question.

Small heights were found to be no better represented in this series than among pilots in general, so no confirmation was obtained in that way of the belief that small pilots were handicapped in controlling the aircraft in an emergency.

### 5. Age-Curves for Weight

Both heights and weights of large numbers of aircrew were obtained. Fig. 5 shows the age-curves for weight for aircrew-recruits and a civilian series. At every age the RAF series shows a greater average height than the employed men (see fig. 3), so the separation of the two weight-curves is not surprising. They are distinguished in another way. All large civilian series show a steady increase in average weight with increasing age up to and beyond age 40. A parallel increase is usually found for Service series up to about age 30, but for later ages there is either a distinct slackening in the rate of increase, or, possibly, as for the recruits, a slight decline. Physical fitness after 30 is not indicated by increase in weight.

FIG. 5. AVERAGE WEIGHTS AT DIFFERENT AGES FOR RAF AIRCREW RECRUITS AND FOR A CIVILIAN SERIES

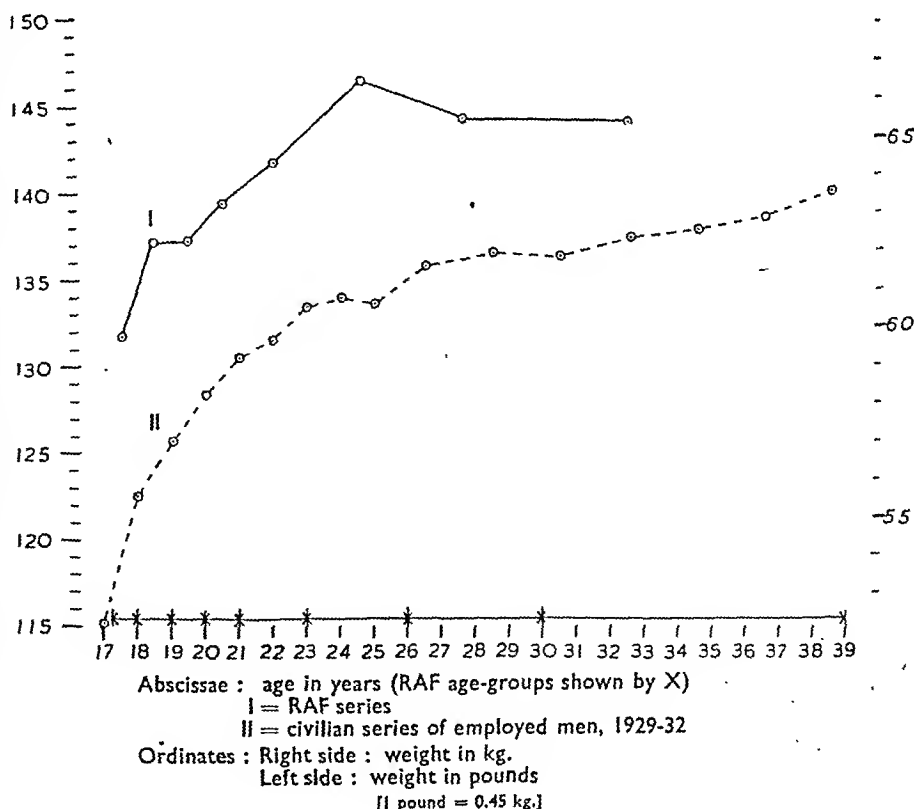
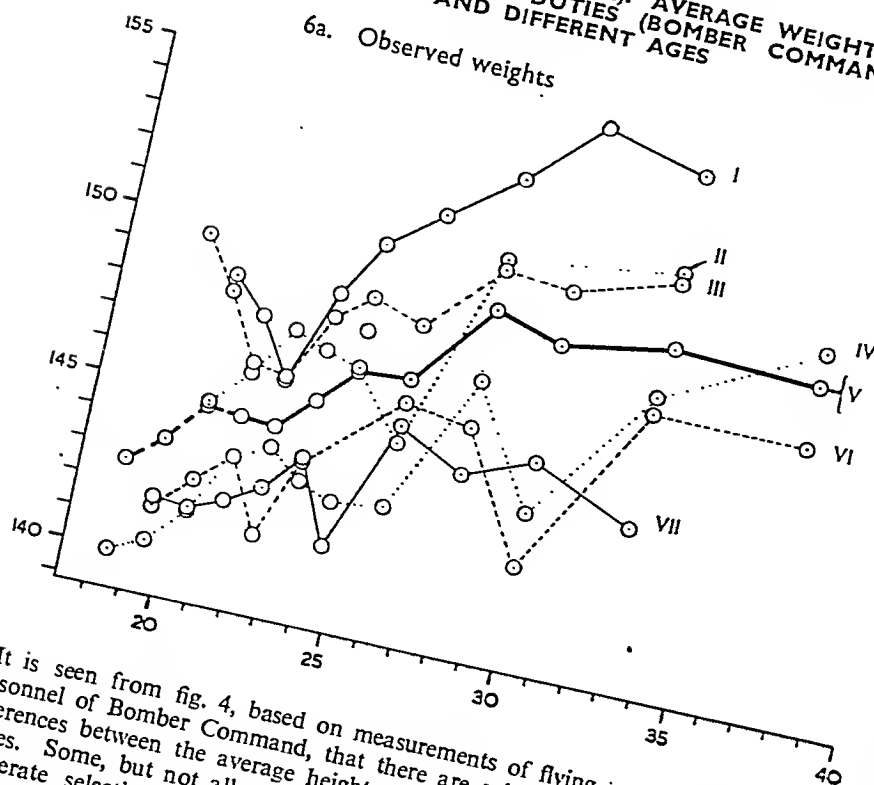


FIG. 6a (UPPER), 6b (LOWER). AVERAGE WEIGHTS FOR DIFFERENT CREW-DUTIES (BOMBER COMMAND) AND DIFFERENT AGES



difference. Most of the recruits were civilians until a few days before the time they were measured. All the operational aircrew had been flying personnel for more than two years and they had been fed—as they fully deserved to be—as well as any people in Britain.

The other three age-curves shown in fig. 7 are for Dominion series of aircrew who were in training or were operating in Bomber Command in 1944 when they were measured. The totals, in round numbers, were 4,000 for the Canadian, 1,600 for the Australian and 550 for the New Zealand series. The average heights are practically the same for the Australian and New Zealand as for the RAF series, and the average height of the Canadians is about 0.5 inch [1.27 cm.] greater. At all ages the Dominion series are clearly separated from the British series by the average weights after allowance has been made for differences in height. This situation may be partly due to the average weights after allowance for differences in height. This situation may be partly due to other factors affecting the selection of the Dominion aircrew, but it seems to me to be probable that it is due primarily, at least, to differences in weight of airmen, the good health-statistics, and the high consumption of dairy-produce in New Zealand. Such questions are chiefly of academic interest. The heights and weights of aircrew collected during the war have been used to serve a more practical purpose. They have given a new age-height-weight table suitable for use

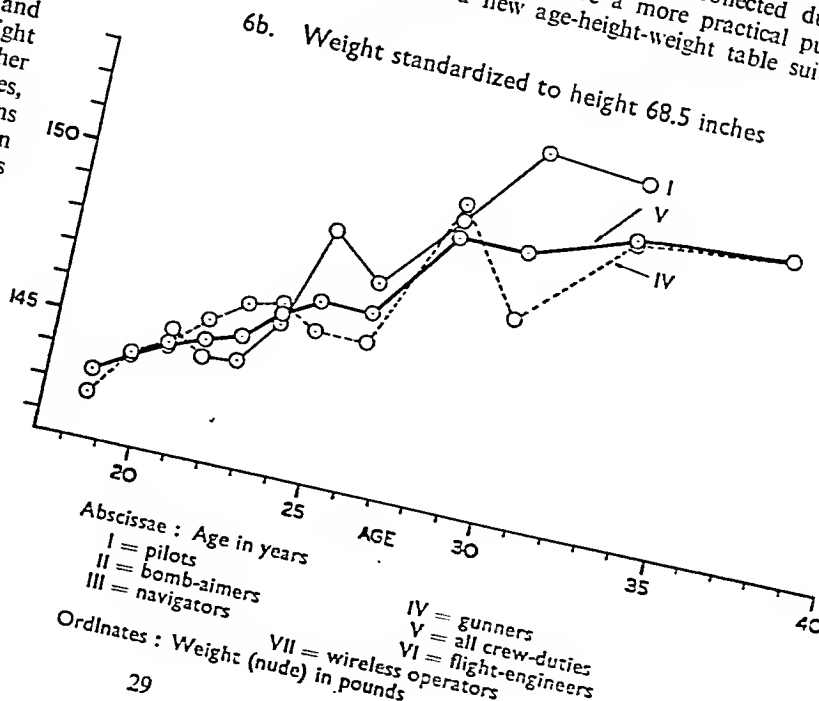
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It is seen from fig. 4, based on measurements of flying personnel of Bomber Command, that there are substantial differences between the average heights for different crew-duties. Some, but not all, of these differences are due to deliberate selection in applying height-limits. The age-curves for weight (fig. 6a) also distinguish the crew-duties and show them in the same order. It is more interesting to compare average weights for the series after allowance has been made for the differences in height.

Fig. 6b shows the age-curves for weight standardized to a height of 68.5 inches [174 cm.] for pilots, air-gunners and all aircrew. For the constant height the pilots are seen to have rather greater average weights at most ages, but the distinction is by no means marked. Allowing for differences in height, it can be said that crew-duties are hardly distinguished from one another on account of weight.

Fig. 7 shows a number of age-curves for weight for air-crew series, all averages used being standardized to a height of 68.5 inches. The two lowest curves are for RAF series, the recruits measured in 1942, and the one above it is for the 12,000 personnel of Bomber Command measured two years later. These two series are scarcely distinguished by heights, but there is a clear difference between the average weights for them. It is not difficult to find a plausible explanation of the



in medical examinations of candidates for flying duties. In constructing this it was assumed that the medical officer will attach little importance to weight unless it is clearly exceptional. For any particular age and height the average weight is given and also two other weights. The first of these is such that only 1% of candidates will be expected to have lesser weights, and the second is such that only 1% will be expected to have greater weights. A range of weights within which 98% of candidates will be expected to fall is thus defined for each age and height.

## 6. Other Applications of Anthropometric Research

Anthropometric research is not limited to height and weight. It may concern many of the medical and other tests used in selecting Service personnel for particular duties, and many of the enquiries relating to the equipment they use and the conditions under which they operate. The following remarks refer less to any part I played in investigating such questions than to the work of others and to research which might be carried out in future.

After a new piece of personal equipment has been designed—say, an oxygen-mask or a flying-suit—a certain number will be made and circulated for field-trials. Those who use the new equipment will be asked to return a questionnaire giving their opinions of its suitability. After these have been examined it may be decided that the equipment is unsuitable, or that it should be modified in certain ways before large numbers are made and the equipment

is adopted for general use. Validation by field-trials is required before that step is taken.

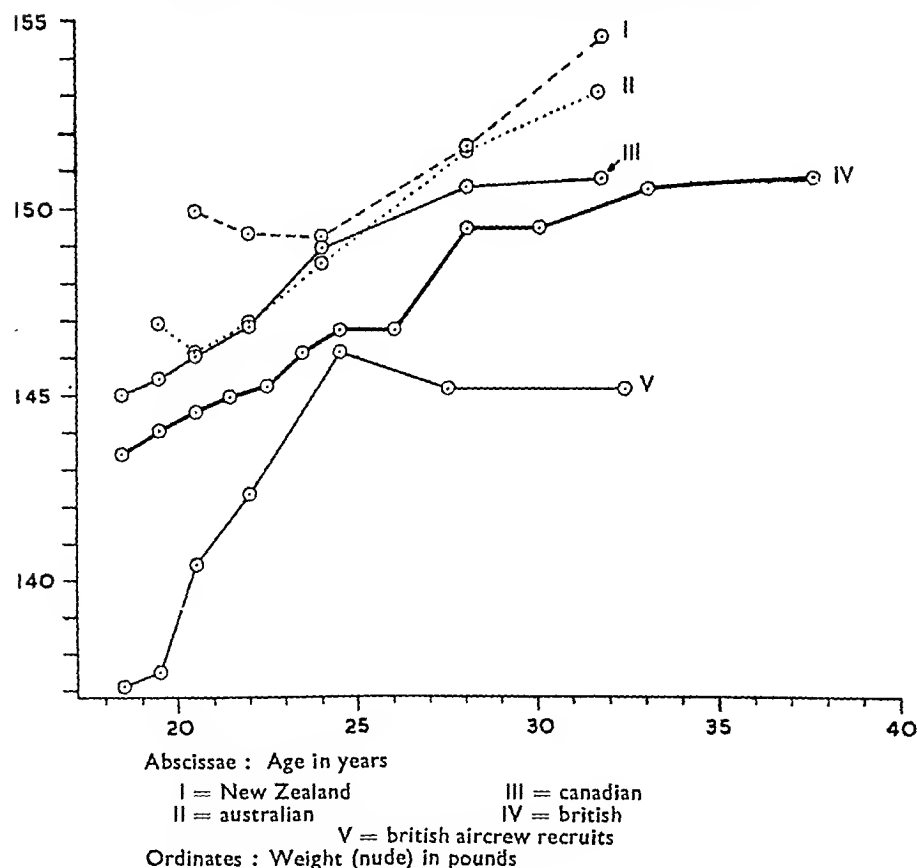
Ideally, at any rate, it should be possible to validate medical and other tests of personnel. One may attempt to do this in various ways. For example, a new laboratory test of night-vision is devised. This may be applied to a number of subjects, giving a grading of them for acuity of night-vision. On a second occasion the test may be applied again to the same series of subjects, and this will grade them in a rather different way. A comparison of the two gradings will give a measure of the reliability of the new test which will show whether it is more or less reliable, judged in that way, than earlier tests of visual acuity at night. This may be the first stage in the testing of the test. The second stage might be the collection of scores for the same series of subjects in a field-trial, such as spotting objects in the open at night. These scores could be compared with those for the laboratory-test. A third stage might be of a different kind. For night-fighter pilots in wartime, say, scores for the laboratory-test could be related to the number of enemy-aircraft shot down, making allowances for the number of hours each pilot had flown and what his opportunities were. It would not be surprising if very little association between the two assessments was found, since many factors besides acuity of night-vision must determine a pilot's score in shooting down enemy-aircraft.

Different methods have to be used, of course, in assessing the validity of different kinds of measurements, but for all tests it must always be possible to estimate reliability by

repeated application to the same series of subjects on two or more occasions. Several of the tests used in Service medical examinations have themselves been tested in this way during the war. The general conclusion seems to be that nearly all tests of the functioning of the body or of the mind show a low degree of reliability. When any one is repeated the grading of a series of men is nearly always found to be substantially different from the grading obtained on the first occasion. It has been shown for some tests that if they are applied repeatedly on different days the average scores may have far greater reliability than single observations. The obvious explanation is that physiological states fluctuate from day to day, from hour to hour, and even from moment to moment, though the levels about which they fluctuate may be characteristic for individuals. There is nothing new in this conclusion, of course, but recent research has emphasized the point that due regard must be paid to it before good validation of several tests commonly taken in medical examinations can be expected.

In all three Services the conditions of modern warfare have necessitated the selection of men who are exceptionally fit for particular duties. The need is for tests which will discriminate grades of fitness, though this can have no precise meaning

FIG. 7. AVERAGE WEIGHTS AT DIFFERENT AGES  
FOR AIRCREW SERIES,  
STANDARDIZED TO A HEIGHT OF 68.5 INCHES



Continued at foot of page 31

## SOME ANATOMICAL AND PHYSIOLOGICAL PRINCIPLES CONCERNED IN THE DESIGN OF SEATS FOR NAVAL WAR-WEAPONS

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Prolonged standing at work is probably one of the commonest causes of avoidable discomfort and fatigue, but until recently the provision of seats has been considered unnecessary and even undesirable, for seats have been thought to encourage laziness and thus, in the armed forces especially, it has been traditional for the operator to stand at his work. However, employers and naval officers have now been persuaded that seats not only afford a valuable method of combating fatigue and thereby increasing capacity for work, but also enable work to be performed with greater accuracy. This is particularly important now that designers are producing mechanisms capable of precision which is limited only by the performance of the operator. Operators should, therefore, sit at their work wherever practicable, but the design of the seat must be based on certain anatomical and physiological principles if the maximum possible efficiency is to be obtained.

The seat must support the body in a normal comfortable position and must be so placed that the operator is in the optimum relation to his work. To arrive at the best design, close co-operation is necessary between the anatomist and the seat engineer, a factor which has been neglected in the past.

This report is primarily concerned with the design of seats for use in naval optical-sights. Nevertheless, as a result of laboratory tests, and from the information obtained from "users," certain general principles can be formulated which can equally well be applied to civilian problems.

### ANTHROPOMETRIC PROBLEMS IN THE ROYAL AIR FORCE

*Continued from page 30*

unless an answer is given to the question: fitness for what? In the RAF the answer is fitness for flying duties. Excellence in a number of qualities may then be demanded, including ability to respond well to certain quite exceptional conditions encountered in military aviation. A close approach to the flying conditions can be produced on the ground with a decompression-chamber which reproduces the atmospheric environment at high altitudes, and with a centrifuge which subjects a person in it to acceleration and sudden changes in speed. It has been found that fit subjects who undergo such tests vary greatly in their responses. So far no physiological tests have been found which would make it possible to predict an individual's response to the unnatural conditions, and there is scope for research in seeking tests which would do so.

### 1. PRINCIPLES AND REQUIREMENTS

The chief requirements of an ideal seat for use with naval war-weapons are as follows:—

- It must accommodate at least 90 % of individuals of different body-dimensions in the most efficient position.
- It must permit the attainment and maintenance of the maximum degree of body-stabilization.
- It must allow the operator to maintain a sitting-position for periods of duty up to four hours without undue discomfort or fatigue, and must allow for an alert and a relaxed position.
- It must combine lightness with mechanical efficiency, withstand very severe usage, and be weatherproof.

#### A. Accommodation of 90 % Range

The seat must accommodate at least 90% of all naval personnel in the most efficient sitting-position but, at the same time, it must occupy the least possible space. It is generally agreed that to consider the remaining 10%, composed of persons at the extremes of the range of anthropometric measurements, would lead to difficulties of design which would outweigh any advantage gained by the increase in the number of potential operators. In order to accommodate persons within the 90% range, the position of the seat must be precisely related in each person to the foot-rest, so that the legs are held in the correct position, and to the eyepieces of the binoculars, so that the eyes are on a level with the optical axis of the sighting-apparatus. To allow persons of different statures to fit themselves to the seat accurately and rapidly, a simple single control to allow simultaneous adjustment of the foot-rest to the seat, and of the seat to the eyepieces of the sight, is advantageous.

It is also of importance that, in the design of the machine, sufficient clearance should be allowed between the body of the operator and the surrounding structures, so that the operator is allowed a certain degree of unhampered movement. If this is not done, part of the surrounding structure may press uncomfortably on the operator, or he may have to assume an awkward posture in order to avoid the pressure. In extreme cases, although the design of the seat may be satisfactory, it may be impossible to man it because this point has not been considered.

#### B. Body-Stabilization

A means of body-stabilization is essential in order to counteract the movements of the ship, gun or director while observations are being made and manipulations carried out.

In conclusion, I should like to say a word about the possibility offered by the medical records kept by the Services in examining the validity of medical examinations. A man starts his military career by having one medical examination and he ends it by having another, while he may have others in between those extremes. If unfit for duty, he will be examined by a medical officer at once and a complete record of any illnesses he may have will be kept. There is no other section of the community for which such complete medical records are available. They make it possible to relate the examination as a whole, or particular tests, to medical histories in general, or to a group of men having a particular disease. There is no lack of scope for research in this field.



Whatever method is adopted, the arms must be left free to operate controls and the mobility of the neck and trunk must not be restricted for sighting-movements. Body-stabilization by the use of a retaining mechanism is undesirable, for it is liable to limit the movement of the arms and trunk and it also unnecessarily adds to the manipulations to be performed by the operator, when he takes up his position, which he may have to do rapidly in the dark. Furthermore, the feeling that the harness, even though it may be fitted with a quick-release catch, may hinder rapid escape, has an undesirable psychological effect. It is, therefore, probable that body-stabilization should be effected by the operator himself with the minimum of muscular effort by counter-pressure between feet against a foot-rest and back against a back-rest.

### C. Reduction of Fatigue

#### i. General Considerations

A correctly designed seat can help to reduce the fatigue of the operator to a minimum by allowing him to sit in a good position. This is a position in which the different segments of the body are balanced vertically upon one another, so that the weight is borne mainly by the bony framework with a minimum of effort and strain on muscles and ligaments (Bowen, 1928) and no arteries or nerves are subjected to excessive pressure. Clinical evidence shows that a close correlation exists between health and good posture (Brown, 1917; Jones, 1933; Steindler, 1935; Hansson, 1945), and that bad posture is liable to cause disabilities involving the skeletal, muscular, circulatory and digestive systems (Goldthwait, 1941). Moreover, it has been shown that corrections in posture increase alertness, vigour and endurance (Osgood, 1931) and improve the circulation and respiration of most people (Laplace & Nicholson, 1936). The improvements occurring from a well-poised body are due to the fact that the various organs are allowed adequate space in which to perform their normal function (Bowen, 1928; Goldthwait, Brown, Swain & Kuhns, 1934; Goldthwait, 1935, 1941). It must be noted, however, that there is no one correct posture for all individuals (Appleton, 1946), because the normal range is large. Thus the design of the seat must be such that it imposes on the operator the best average position.

When rest-pauses can be taken, even if the pause lasts only a minute, the operator must be able to change his posture, thereby promoting the circulation through fatigued muscles (Vernon, 1922). This can be effected by allowing the operator to slide forward in his seat and lean against a back-rest. This has the added advantage that some of the body-weight is distributed to the back, thus relieving the pressure on the skin over the buttocks. Even a few minutes in a reclining position provides more rest than can be obtained by small changes in the upright position (Gilbreth & Gilbreth, 1919).

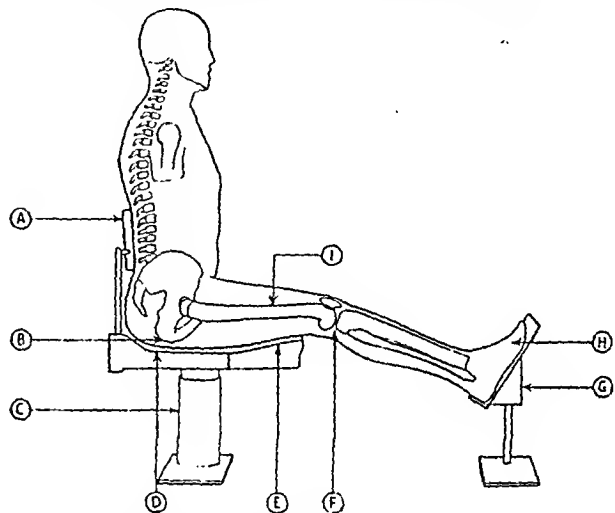
#### ii. Principles of Design

In order to realize these ideals, the design of the seat-cushion, foot-rest, and back-rest must be considered in detail:

a. *Seat-cushion* should be wide enough to accommodate subjects of maximum dimension within the 90% range wearing thick winter-clothing, as well as allowing a certain amount of lateral movement. Its depth from front to

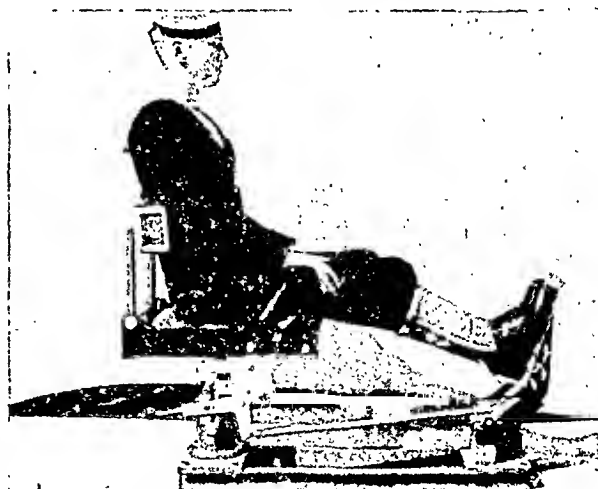
back should be sufficient to afford light support for the thighs almost to the hollow of the knee (Hebestreit, 1930), but the thighs must not press heavily against the front edge of the cushion, for this may lead to discomfort and possibly to interference with the blood-supply to the legs. The cushion must not project so far forward that it prevents the free movement of the legs. It is desirable that the part of the cushion supporting the ischial tuberosities should be flat and disposed horizontally. The main advantages of this are that:—

FIG. 1. "IDEAL" SEAT FOR EFFECTING BODY-STABILIZATION BETWEEN FOOT-REST AND BACK-REST



- A Back-rest fits lumbar region. Note its depth and the position of the pivot
- B Ischial tuberosities bear most of the weight
- C Seat adjustment
- D Back of cushion firm and resilient
- E Front of cushion soft and resilient
- F Knee-angle 160°
- G Foot-rest moves upwards and towards seat to accommodate smaller persons
- H Foot at right-angles to leg
- I Thigh horizontal

FIG. 2. SEAT FOR USE IN NAVAL WAR-WEAPONS



Note that the seat is not correctly adjusted compared with fig. 1

- i. it allows accurate and reproducible measurements to be made, for instance, those between the top surface of the seat-cushion and the optical axis of the sight, and between the top surface of the seat-cushion and the back-rest;
- ii. it permits the operator to change his position readily during periods of relaxation. This gives periods of rest to different muscles and thus prevents strain of any individual muscle-group, and also allows the transfer of pressure from one part of the buttock to another during prolonged watches, thus minimizing fatigue and discomfort;
- iii. the operator is able to slip forward on the cushion as may be necessary when sighting at high angles, and
- iv. access to and escape from the seat are facilitated.

The cushion should be resilient (Hebestreit, 1930; Kindeberger & Atwood, 1935; Beal, 1945), but the resilience should be only in a vertical plane, as any lateral or antero-posterior sway will lead to instability and consequent difficulty in keeping the eyes applied to the binoculars. The extra muscular activity thus necessitated will increase the liability to fatigue. The resilience should be of such a degree that the body-weight, taken on the buttocks, is distributed over as large an area as possible, with the proviso that the maximum pressure remains over the ischial tuberosities. This last consideration is of importance as the ischial tuberosities are the normal anatomical supports of the seated subject, and they serve not only to protect the adjacent soft parts from undue pressure, but the skin over these bony eminences, unlike that surrounding it, is specially modified in blood-supply to withstand prolonged pressure (Edwards & Duntley, 1939).

If the seat-cushion is too soft, the excessive transfer of pressure to adjacent parts may cause serious discomfort. The resilience should be such that the variation of the degree of compression of the cushion does not exceed 1 inch (2.54 cm.) with persons of different body-builds. This is particularly necessary in seats which have a simultaneous adjustment of seat-height and foot-rest position, as this adjustment is based on the fact that there is a close correlation between leg-length and sitting-height. If the range of compressibility is greater than 1 inch, the correct relation between the foot-rest, seat and sight can no longer be maintained.

Initially, it had been hoped that, as there is a fair correlation between height and weight in the individual, a direct relationship would be found between the sitting- or standing-weight of the individual and the degree of compression of the cushion, so that allowance could be made for the variation of compression in different persons in the seat-adjustment. Practical tests showed that no direct relationship existed. The reason for this is that compression depends upon several variable factors in addition to the weight. These are the area compressed, and the distribution of the weight over this area; variations in the resilience of different parts of the cushion; and the attitude of the subject and his degree of relaxation. The resilience should remain of the same degree after prolonged use and the cushion should not assume a permanent change of shape. The design of the cushion should be such that all cushions to be fitted to the same model of ocular sight can be manufactured with a standard degree of resilience. A resilient cushion helps to eliminate transmitted vibrations, which are one of

the causes of unnecessary fatigue (Gilbreth & Gilbreth, 1919; McFarland, 1941).

b. *Foot-rest* should be placed so that, at the ankle, the foot is maintained at right-angles to the leg, for, in this position, at rest, both the anterior and posterior groups of leg-muscles are relaxed and, when exerting pressure, both groups are contracting equally and no undue strain is thrown on either group. The relation of the seat to the foot-rest must also be determined accurately, so that, when the seat-height is adjusted to the ocular height, the knee-angle will be such that maximum counterpressure can be developed. In addition, the foot-rest must be long enough to accommodate the widest foot, and wide enough to accommodate the pressure. A heel-rest should be provided for exerting feet slipping off the foot-rest.

c. *Back-rest* should afford comfortable resistance against which the body can be braced in order to keep it steady (Müller, 1936; Koch, 1941). At the same time, it must not restrict extension and backward bending of the spine or movement of the arms. A complete support for the back is not possible, owing to the limitations of space and weight, and also owing to the restriction this would impose on the movements of the spine. This being so, the most efficient support for the back can be provided by a back-rest fitting accurately into the lumbar hollow (Hebestreit, 1930). This allows free mobility at the thoraco-lumbar junction of the spine, where the greatest degree of spinal movement occurs (Gallois & Japiot, 1925; Bowen, 1928). If the rest is placed higher than this, movement of the spine is restricted, and the rest tends to press uncomfortably against the thoracic curvature, leading to a flattening of the lumbar hollow and a faulty sitting-position with consequent early onset of fatigue.

For optimum efficiency, the pressure applied to the back-rest must be distributed equally over as large an area as possible. If pressure is localized to a small area, it will cause discomfort and even pain, and is therefore liable to limit the degree of counterpressure which can be developed and so render body-stabilization inefficient. In order to realize these requirements, the transverse curve of the back-rest must conform to the anatomical curvature of the lumbar region, and the dimensions of the back-rest should permit the accommodation of individuals of varying sizes. The rest should be suitably padded and have broad rounded edges. The rest should be so pivoted about a transverse axis that it automatically adjusts itself to fit the different slopes of the back in different people when sitting erect, and to the changing contours of the back during sighting-movements. It should be collapsible, so as to allow easy access when the seat has to be entered from behind.

Originally it was recommended, with the idea of minimizing fatigue, that a lower (lumbar) and an upper (shoulder) rest should be incorporated in all seats which have to be occupied for long periods, and also in seats to be occupied by personnel subjected to alternating periods of activity and rest. Practical tests have shown, however, that the upper rest is unnecessary when the seat is provided with a correctly designed lower rest.

D. *Mechanical Factors*  
Apart from the anthropometric, anatomical and physiological requirements outlined above, there are mechanical

factors which must be taken into consideration. The individual components of the seat-assembly must be capable of withstanding very severe usage under extremes of climatic conditions. They must be durable, weather-proof, sea- and freshwater-proof, oil-proof, rot-proof, termite-proof and fire-proof. The construction of the seat must combine maximum strength with the minimum of weight and size, and must provide for easy maintenance. Finally, the design must not interfere with rapid access to or escape from the seat.

## 2. DISADVANTAGES OF THE BUCKET-SHAPED SEAT

The shaped or "ploughman" seat with a perineal elevation (or pommel) has been widely used in the Royal Navy, but it is clearly unsatisfactory in all respects:

- i. The subject fits in the seat "like a snail in its shell," and thus for comfort it is imperative that the buttocks should be related correctly to the corresponding concavities of the seat. The size and shape of the buttocks, however, varies considerably from person to person, so that few people can fit comfortably into a seat of one particular size and shape.
- ii. The shaped seat results in pressure being fairly evenly distributed over the whole surface of the buttocks. Therefore, the maximum pressure is taken off the skin over the ischial tuberosities and excessive pressure is applied to the surrounding areas. As pointed out previously, anatomical considerations make this undesirable.
- iii. It is difficult to change the position of the buttocks even slightly in the alert position, and almost impossible to adopt a position of comfort during periods of relaxation.
- iv. The design of the seat makes the presence of drainage-holes in its most dependent part essential to prevent the operator sitting in a pool of water. Such holes and other irregularities of the seat-surface are to be strongly deprecated, for they cause localized areas of skin to be subjected to excessive pressure with resulting discomfort.
- v. The perineal elevation is presumably designed to prevent the buttocks slipping forward with the movements of the ship. However, any advantage gained in this respect is more than counterbalanced by the discomfort that may be caused by the effects of prolonged pressure in the perineum. In any case body-stabilization can be better provided by the method of counterpressure between back-rest and foot-rest.

## 3. DIMENSIONS AND DETAILS OF DESIGN<sup>1</sup>

### A. Anthropometric Data

The calculations for the dimensions of the seat are based on an american report. This is used as a standard reference for anthropometric data, because it was available before any british survey and because the method of presentation of the data is particularly suited for use in the problems with which we are concerned. From the point of view of our investigations, comparison of the measurements compiled in the american survey with the body-measurements of

british tank-personnel and with our own observations showed no appreciable differences between the selected groups of american and british subjects. On occasions when no relevant data were available, the required measurements were obtained from representative groups of individuals.

### B. Vertical Adjustment of Seat

In order to accommodate operators within the 90% range so that the eyes of the operators of varying sitting-heights are in line with the sight, the seat must have a vertical adjustment of 4 inches [10 cm.].

### C. Body-Stabilization

For naval purposes, body-stabilization is of prime importance, and it was therefore given first consideration in the design of the seat. As mentioned earlier, body-stabilization is best achieved by counterpressure, and the ideal position for body-stabilization is the one in which the maximum counterpressure can be developed between the feet and the back. The more the position varies from the optimum, the greater the output of energy necessary to maintain equivalent pressures, since the muscles are working at a decreasing mechanical advantage. Previous work on naval problems indicated that the thrust of the legs against a foot-rest rises with the increasing knee-angles, at least up to 135°. A later investigation by Hugh-Jones (1947) went further and showed that (i) when the angle of the thigh to the body remains constant, the maximum thrust rises as the knee-angle increases up to a well-defined "limiting angle" of 165°-170° above which, as the knee straightens and then hyperextends, the thrust obtainable falls precipitously; (ii) with the knee at this angle (165°), the maximum pressure can be obtained when the angle of the thigh is 70°-75° to the body; (iii) the mean maximum instantaneous thrust of 32 service personnel was 691 pounds [313 kg.], and it was concluded that 500 pounds [227 kg.] could be reasonably expected of all persons. These findings support those of Müller (1936). He found that maximum thrust with the legs in a seated subject was obtainable when the seat-surface was at the same height,  $\pm 4\frac{1}{2}$  inches [12 cm.], as the feet, and the distance from the back of the seat to feet was 2-4 inches [5-10 cm.] shorter than that of the outstretched leg. In the optimum position, one subject exerted a maximum force of 430-450 pounds [195-204 kg.].

It has been demonstrated that, in the range of leg-angles investigated (i.e. thigh to vertical 75°-90° and knee-angle 90°-135°), the pressure that could be maintained without discomfort was an average of 54% of that developed instantaneously. Although it has not been investigated in the optimum position, it is reasonable to suppose that a similar relationship will hold. This fact makes it all the more important that the operator should be in the best possible position for exerting pressure as, although he may be able to obtain in other positions more than the pressure required for instantaneous body-stabilization, he will be less able to maintain it.

As noted above, maximum pressures are obtainable when the thigh is at an angle of 70°-75° to the body-axis. However, the position imposed on the operator would prove uncomfortable if maintained for long periods as, when the thighs are elevated, the pelvis tilts and the weight of the body is transferred from the skin over the ischial tuberosities to

<sup>1</sup> Full details are given in a report by H. D. Darcus (1946) to the Gunnery Sub-Committee of the Royal Naval Personnel Research Committee.

that over the sacrum and gluteal muscles, which is not designed to withstand prolonged pressure. Furthermore, elevation of the thigh would necessitate the seat being sloped correspondingly in order to support it. This is undesirable as it would lead to complications with regard to the adjustment of the eyes to the eyepieces of the binoculars. It was decided that the advantages of increased counterpressure gained by sloping the thighs are outweighed by the complicating factors introduced. Therefore, it was concluded that the ideal position for body-stabilization in ocular sights is with the thighs horizontal and the knee-angle at  $165^\circ$ .

The explanation of the existence of a well-defined limiting angle seems to be due to the fact that, with a man of average bodily dimensions sitting with his legs in such a position, the line of thrust passes through the pivotal axis of the back-rest, when the latter is in the optimum position. If the knee-angle is smaller, the thrust is directed above the back-rest, so that when exerting pressure with the feet, there is a tendency (which has to be restrained) for the upper part of the body to be pushed back. Conversely, if the knees are held at an angle greater than  $165^\circ$ , the thrust tends to incline the body forward. Both these movements result in instability and loss of counterpressure. Recently, it has been shown (Haxton, 1945) that, in cadavers, the increase of tension resulting from increasing the knee-angle may be due to the patella being drawn upwards over the femoral condyles and thus being displaced further from the centre of the knee-joint as the knee is extended; this allows the quadriceps femoris muscle to work at a greater mechanical advantage.

From the observations outlined above, it will be obvious that it is necessary to have a seat with a foot-rest adjustable so that, in different individuals, a knee-angle of  $165^\circ$  is possible. In practice, an angle of  $160^\circ$  is aimed at, for when counterpressure is applied the knee-angle tends to increase due to "give" in the seat-structure.

Tests have shown, that, when in the optimum position, the stability is so great that a subject can remain in the seat when it is rolled from side to side, even when less than the maximum counterpressure is being exerted. In naval warfare, it has been estimated that the maximum extrinsic force tending to displace an operator from his seat is about 200 pounds [90 kg.], whereas the mean pressure that can be maintained with each leg in the position described is about 500 pounds [227 kg.]. Care should be taken that the mechanical design of the seat is sufficiently robust to withstand these pressures without undue "give" or fracture.

#### D. Seat-Cushion

i. *Dimensions.* Reference to anthropometric data shows that the minimum satisfactory width of the seat-cushion is 15 inches [38 cm.]. The antero-posterior depth of the cushion has to be limited to the length of the underside of the thigh of the smallest individual in the 90% range, in order to prevent interference with the movement of the legs and to prevent pressure on the back of the knee. From this consideration, it is recommended that the depth of the seat should be 18 inches [46 cm.]. It was found, however, that a seat-cushion of these dimensions was not wholly satisfactory, for when the subject is sitting with the upper surfaces of the thighs horizontal and the knee-angle at  $160^\circ$ , the distal part of the underside of the thighs is left unsupported by the cushion, because the underside of the

thigh slopes upwards at an angle of about  $10^\circ$  to the horizontal in the average subject. To allow for this and, at the same time, to retain the advantages of a flat seat, the front 8 inches [20 cm.] of the cushion should be sloped to an angle of  $10^\circ$  to the horizontal and the back 10 inches [25 cm.] disposed horizontally.

ii. *Resilience.* As a result of comparative tests, we have found that the most suitable method of padding the seat-cushion to obtain the required resilience without lateral or antero-posterior sway consists of tempered-steel strips fixed to a steel base-plate. This method has the added advantages that the steel strips can be made to give any required degree of resilience and that they are extremely durable. Moreover, the resilience does not vary even with prolonged use. Being metal, the springs are fire- and mould-proof. Rust can be combated by cadmium-plating.

The springs should be fixed transversely as, no matter where the buttocks of the operator are placed in an antero-posterior direction, the degree of resilience will then be the same. The risk of sitting on the insertion of the spring, where there is little or no resilience, or of pressure from this part of the cushion on the underside of the thighs, is also avoided.

It is important that the front part of the cushion should be rounded and softly sprung to prevent undue pressure on the underside of the thighs, and also to allow for any variation in the slope of the underside of the thighs in different individuals.

iii. *Seat-covering.* Tests have shown that the most successful seat-covering is first-quality tropicalized hide or certain polyvinyl chloride leather-cloths, both of which fulfil all the requirements for naval use. The seat-covering should be fluted transversely. This allows the covering to be slack, so that no undue strain occurs when the cushion is compressed. Furthermore, the shallow furrows between the flutes permit air to circulate between the cushion and the buttocks of the operator. They also provide channels along which water can drain from the surface of the cushion. The flutes are transverse to avoid uncomfortable pressure into the natal cleft. A layer of DDT-impregnated rubberized horsehair stitched to hessian is interposed between the seat-covering and the springs to act as a "buffer". Incidentally, it adds to the resilience of the cushion. The horsehair is sewn into the flutes to prevent it from moving with use.

#### E. Foot-Rest

The position of the foot-rest in relation to the seat was determined by reference to the optimum position of the legs for body-stabilization. In order to allow subjects within the 90% range to sit with their legs in the correct position, the foot-rest must be adjustable. Fortunately, there is a good correlation between the leg-length and sitting-height, so that a link-mechanism can be used which permits simultaneous adjustment of the seat-to-ocular-height and seat-to-foot-rest lengths by moving a single lever. For the largest man in the 90% range, the lowest part of the foot-rest should be 8 inches [20 cm.] below the level of the compressed seat-cushion and  $47\frac{1}{4}$  inches [120 cm.] from the back of the seat and, for the smallest man in this range, the lowest part of the foot-rest should be 7 inches [18 cm.] below the level of the compressed cushion and 41 inches [104 cm.] from the back of the seat. The

slope of the foot-rest should be at right-angles to the leg-bones, and as the leg is held at  $20^\circ$  to the horizontal in the optimum position, the foot-rest should slope at  $110^\circ$  to the horizontal. The length of the foot-rest should be 14 inches [35.5 cm.] and the width 15 inches [38 cm.]. A heel-rest must be fitted to the lower end of the foot-rest. It should project at right-angles to the foot-rest and be at least 3 inches [8 cm.] deep in order to give efficient and comfortable support to the heel.

#### F. Back-Rest

i. *Dimensions.* As mentioned under the requirements, the back-rest should be placed so that it corresponds to the maximum concavity of the lumbar curvature. The height of maximum concavity of the lumbar curvature above the ischial tuberosities was determined, and, in individuals within the 90% range of sitting-height, it was found to vary between 8 inches [20 cm.] and 12 inches [30 cm.]. It was thought at first that a back-rest of adjustable height would be necessary in order to give sufficient support to the back of all individuals (Hebestreit, 1930), but practical tests showed that a back-rest 5 inches [13 cm.] in vertical depth, which is almost the same as that recommended by Hebestreit (1930), and with its centre  $10\frac{1}{2}$  inches [27 cm.] above the compressed seat-cushion is satisfactory. A back-rest of this width is sufficient to support the pelvis directly, which is important if maximum pressure against a foot-rest is desired (Müller, 1936). If the pelvis is not supported the back-muscles are liable to undergo considerable strain to keep the pelvis in position, and the maximum pressure is decreased. The back-rest should be placed 1.27 inch [3.2 cm.] behind the back edge of the seat in order to allow for a good sitting-position for the operator. The curve of the back-rest should correspond to the natural curvature of the lumbar region as accurately as possible. The average curve, 10 inches [26 cm.] above the level of the seat in subjects sitting erect, was found to be the arc of a circle of radius  $7\frac{5}{8}$  inches [18.5 cm.]. The width of the back-rest should be 15 inches [38 cm.].

It has been estimated, from the fact that the pressure exerted against the back-rest by counterpressure from the trunk is considerably greater than that derived from the weight of the trunk, that the pivot should be placed a distance below the level of the back-rest. A satisfactory position was found to be 1 inch [2.54 cm.] below the centre of the back-rest.

ii. *Padding.* It is recommended that the back-rest should be padded similarly to the seat-cushion. It should consist of four horizontal  $\frac{1}{2}$  inch [1.27 cm.] tempered-steel-strip springs fixed to a correctly curved steel-plate. If the springs are disposed vertically, hard upper and lower borders will result. The curved steel-plate must be strong enough to prevent bowing. The springs should be covered with first-quality tropicalized hide or polyvinyl chloride leather-cloth with rubberized horsehair interposed between the covering and the springs. The borders of the back-rest should be widely curved and the corners should be curved from above downwards as well as from before backwards, thus forming quadrants of a sphere, the radius of which should be about 2 inches [5 cm.].

The supporting frame of the back-rest should be collapsible in order to facilitate entry to the seat, when necessary, from the rear.

#### G. Lateral Thigh-Support

It was found during the course of investigation on the anatomical seat that the comfort of the operator is increased considerably by the attachment of lateral thigh-supports to the distal part of the sides of the seat. They prevent too great a degree of passive lateral rotation and abduction of the thigh, which tends to occur in this position, and so obviate strain on the muscles of the inner side of the thigh (the adductor and medial rotator muscles) which must otherwise remain in a state of permanent tonic contraction in order to resist this movement. The muscular activity thus necessitated in the absence of these supports is liable to lead to fatigue. They can help to aid body-stabilization to some extent if the thighs are forced against them, and they will also assist in preventing the operator being thrown from his seat with an unexpected movement of the ship. Furthermore, the supports can be so placed that controls attached to them are in the correct position for precise manipulation by the hands. The inner surface of the supports should be flat and the edges rounded. No padding is necessary, as the pressure against the supports will neither be of great magnitude nor prolonged, but they should be covered with heat-insulating material.

It is suggested that these supports should be fitted whenever practicable, but they can be removed in circumstances in which they are liable to interfere with the manning or leaving of the seat.

#### 4. ADJUSTMENT OF THE SEAT

In order to derive full benefit from good seating, it is absolutely essential that the operator must be able to adjust himself rapidly and accurately to the seat. The adjustable seat can be made completely satisfactory provided that there is sufficient supervision to make sure that each seat is in fact kept properly adjusted to the needs of the individual. It is recommended that this should be the specific duty of one particular officer. All operators should at some convenient time be fitted to the seat by the responsible officer, and each should be given the number or letter of his seat-adjustment, so that when he has to take up his position in the seat he can immediately adjust it correctly (fig. 2).

It is obvious that, although in general there is a good correlation between sitting-height and leg-length, this is not absolute. A further variable that has to be borne in mind, and which is liable to alter the correlation, is the variation in the thickness of the soles of the different types of footwear worn under operational conditions. Therefore, not all subjects will be able to sit in the optimum position, and the seat-adjustment of some will have to be determined intelligently. For example, the correlation of leg-length with sitting-height may vary, even in the 90% range. Since it is essential in all cases to relate the eyes correctly to the binoculars, in some subjects it may be impossible at the same time to achieve the optimum position of the legs.

#### 5. CONCLUSION

This paper describes the desiderata for, and the design of, an adjustable seat for use in naval war-weapons. Although this seat was specifically designed for use with sighting-apparatus, the principle of maintaining stability by the use of counterpressure between the feet and the back-rest is so important that similar seats are to be tried experimentally in other situations aboard ship. It may also be pointed

*Continued at foot of page 37*



## PERSONNEL SELECTION IN THE ROYAL NAVY

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*Senior Psychologist to the Admiralty*

Almost exactly six years ago the Admiralty decided to overhaul the procedures adopted in selecting new recruits for the Navy and in allocating them to their various naval employments. They asked the National Institute of Industrial Psychology to take part in a preliminary survey, and I was fortunate enough to be detailed for the task. A committee of three—Dr. Desmond Curran (the Navy's consultant in psychological medicine), an executive officer, and myself—toured the country for several weeks, collecting evidence about the nature and efficiency of the existing methods of selection and allocation. We returned to the Admiralty loaded with information and ideas, which we fashioned into two schemes for immediate application. One scheme was designed to improve the existing selection procedure in Combined Recruiting Centres; the other was intended to improve the allocation procedures used in the Navy's Entry Establishments.

### Scheme for Combined Recruiting Centres

The routine procedure of the Combined Recruiting Centre we had found to be of a fairly primitive kind. The recruiters were mostly pensioner chief-petty-officers and petty-officers, and their job was to interview very briefly men who had chosen service with the Navy. At the end of each interview they had to decide whether the candidate should be accepted or rejected. In the case of the accepted men, they had to go further by designating each one for a particular branch of the Navy.

It seemed clear from our survey that this plan was faulty, especially because it was admitting men of low intelligence and men of low stability. What was needed primarily, we felt, was a more thorough survey of each candidate's past record before a decision was made about him. So the Admiralty agreed to provide the pensioner-recruiters with

recruiting assistants. They agreed, moreover, that these recruiting assistants should be well-chosen personnel from the Women's Royal Naval Service (Wrens). The Wrens were to be selected and trained for the purpose and were to be supervised, in their recruiting centres, by three peripatetic psychiatric social-workers. They and their supervisors were to be members of the staff of the newly-formed department of the Senior Psychologist at the Admiralty. It had been agreed that the Senior Psychologist himself should be directly responsible to the Second Sea Lord, the Chief of Naval Personnel.

The Wrens went to their recruiting centres in pairs with a four-point programme. First, to get each candidate for the Navy to complete a simple biographical questionnaire; secondly, to give him a paper-and-pencil intelligence test of the non-verbal type; thirdly, to give him a colour-vision test of the Ishihara type; and fourthly, to interview him. The object of this procedure was to collect relevant data about each man before the recruiter saw him at all. It enabled the recruiter to start his own interview with a solid foundation of fact about each candidate's qualifications.

### Scheme for Entry Establishments

The second scheme produced changes in the routines adopted in Entry Establishments in allocating accepted men to their particular employments. There were, at that time, six or seven large establishments receiving up to about 500 men a week each. For example, one establishment dealt with men who had been selected by recruiters for the air-mechanic branch of the Fleet Air Arm. Its function was twofold: first, to allocate all its entries to the electrical, engine, airframe and ordnance categories; and secondly, to detach the most promising of the men in each category for higher-grade training which would raise them from the mechanic group to the status of fitters.

In this particular establishment, the new routine worked in this way. On the day after entry, a batch of new recruits had what was called an "information hour," in which three people gave twenty-minute talks. First came the Training Commander, who welcomed them to the Navy and spoke simply and effectively about its traditions of comradeship, gallantry and discipline. The schoolmaster talked to them about the importance of mathematics to all air-mechanics and, in humorous vein, encouraged them to tackle the subject seriously. Last came the resident civilian-psycholo-

### ANATOMICAL PRINCIPLES IN DESIGN OF SEATS

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out that many of the other principles of seating elucidated in this investigation may be directly applied to the design of seats for industrial purposes. It is important, however, to realize that

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gist, or his senior personnel-selection officer (P.S.O.). The aim of their contribution was to outline the duties and training-programme appropriate to each of the categories available, and to say something about the regulations for pay and advancement. By judicious emphasis on one factor or another, an attempt was made to ensure that the preferences later to be expressed by the men agreed reasonably well with the current "quotas" laid down by the Director of Manning. For example, there was always likely to be an excess of candidates for the "engine" categories, so it was regarded as permissible for the P.S.O. to draw attention to the fact that this was a rather dirtier kind of job than the others.

The "information hour", then, constituted the first stage of the new allocation-procedure for use in Entry Establishments. It was regarded as being of considerable importance, because it was believed that, given accurate and relevant information, the men would themselves be stimulated to do a little self-selection for their naval employments.

The second stage consisted of some standard written tests for intelligence, mathematical attainment and mechanical aptitude. We seldom made use of practical manipulative tests, because for ordinary purposes of selection few of them are really worth the time they take.

The third stage of the Entry Establishment procedure consisted of about 22 hours' schooling in mathematics provided by the schoolmaster. It began with an examination and finished with a parallel examination designed to show what progress had been made by each man during his short course of instruction.

The fourth stage, which came some five weeks after the recruit's entry, was his interview with a P.S.O. The main aim here was to discover what ideas each man had formed about his suitability for the various categories available and to consider them in the light of his qualifications as revealed by the interview and by the data provided by the tests he had taken earlier.

The fifth stage was the "categorization conference," at which the Schoolmaster of the Training Commander—the P.S.O., the schoolmaster and the divisional officer (company commander) concerned discussed each man and arrived at a decision about his allocation. Sixth and last came the promulgation of the decisions. This was done in a rather formal manner, at a meeting deliberately planned to be reminiscent of a prize-giving. The announcements were made by the divisional officer concerned. But he omitted the names of men who had not been allocated to any of the categories for which they had expressed a preference. These men were told to stay behind. Each of them was given a private and sympathetic explanation of the decision reached by the categorization conference and was told that he could make an appeal on the following day if he wished to do so.

#### Results of the Schemes

Afterwards, the men went from the establishment to other places for their specialized training. Careful follow-up was done, and it was later found that the introduction of the new allocation-procedure had apparently produced a substantial reduction in the over-all failure-rate in technical courses. Formerly the failure-rate had been 14.7%; now it was exactly 4.7%. A financial calculation by an independent assessor indicated that the saving in the air-mechanic and air-fitter groups alone amounted, in a twelve-

month period, to about £100,000. The number of cases on which this estimate was based was no small sample; the enquiry covered 16,500 men.

So much for the Navy's Combined Recruiting Centre and Entry Establishment schemes. The former has been applied, so far, to over 950,000 men (including, of course, men rejected as unsuitable for the Navy). The latter has been applied to about 400,000 men; that is, to over half the wartime Navy.

#### Procedure for Officer-Selection

Finally, I must make some reference to the development of new officer-selection procedures. Here we proceeded more slowly, for several good reasons. Our first task was to discover experimentally whether an ordinary written intelligence-test would help in the elimination of intellectually-unsuitable candidates. We did this by giving a standard test to about 500 cadets at the very start of their officer-training, and by locking up the papers until they had all had a chance to be promoted to commissioned rank. Then a comparison was made between their intelligence-test results and their passing-out marks. The agreement was found to be high, and it was clear that if the results of the test had been disclosed, and had been used in the sifting of the cadets, most of the potential failures could have been eliminated at the cost of only a very small proportion of the men who actually managed to gain promotion.

Having demonstrated the value of an intelligence-test for this purpose, we went on to demonstrate the value of an industrial psychologist's interview. Another 500 men took part in this experiment. Each was interviewed for fifteen or twenty minutes by a psychologist, and a short written report was prepared immediately. Later follow-up indicated that the board's assessments proved justified in 61% of the cases; the industrial psychologist's score was 71%. The conclusion reached from a detailed study of the data was that an ordinary selection board aided by reports from a psychologist could probably make appreciably better predictions than either of them could make independently.

These two investigations—into the value of an intelligence test and an industrial psychologist's interview—led to the general adoption of these two techniques and to still further developments. A modification of the War Office Selection Board method was introduced, and has since been applied to over 10,000 candidates for temporary commissions in the Navy. There are two major differences between the War Office and the Admiralty arrangements. First, the Admiralty's procedure is normally spread over a three-month preliminary training period, instead of being concentrated into two or three days. In this way the Navy is able to take into account impressions formed by training officers over a long period. Secondly, the Admiralty Selection Boards have no psychiatrists or educational psychologists on them. All the psychological testing and interviewing is done by an industrial psychologist.

Let me add in conclusion that when the Senior Psychologist's Department at the Admiralty was founded in 1941 it was agreed that it should be concerned not only with personnel-selection problems but also with other psychological matters. It deals, for example, with training and examination procedures, with documentation, with methods of work and with the improvement of working-conditions. This we arranged quite deliberately. Our pre-war experience in the field of industrial psychology had led us to the conclusion that it would be unfortunate if we were forced to attend to only one side of the task of fitting the new sailor to his wartime job.

## PSYCHOLOGICAL PROBLEMS IN FLYING PERSONNEL

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- 1 Methods of psychological selection
- 2 Role of the psychiatrist
- 3 The "Harrogate Experiment"
- 4 Research in Bomber Squadrons
- 5 Fear
- 6 Limiting operational duties
- 7 Endogenous factors

When considering the problem of the psychological management of aircrews, it is important to realize what a big problem this was in the war which has just ended. It was not big simply because of the numbers of men involved, but also because of the disastrous consequences of the continued inefficiency of one member of an aeroplane's crew. When a man had been fully trained, he was in action against the enemy for a comparatively short time—for a maximum of about 30 trips in a bomber-tour of duty, or 200 hours in a fighter. During the major part of this time in the air he was not actually engaging the enemy, and indeed reconnaissance in Germany showed that quite a small proportion of the bombs dropped found an important target. Only when all the members of a crew were highly efficient, and were also successful, was the return worthy of the fortitude needed to complete a tour of operations, whether this was carried out in bombers, fighters, or reconnaissance.

But another aspect of this balance must be considered—the economic aspect, which sets against the damage done to the enemy all the time of instructors, ground-staff and aircraft, in training a man and in keeping him in the air, and all the manpower needed to design, build and maintain the aircraft which he uses. When this is considered, it is seen that the airman stands at the apex of a very wide pyramid, and that the waste incurred by the inefficiency of a member of a crew who vitiates the result of a single trip must be measured upon this basis. This crucial man, the airman, worked in an environment of physiological and psychological stress which was bound in time to reduce his efficiency, and his welfare presented problems of the first importance which were probably unique in the fighting services.

Psychological problems existed in all stages of training in aircrew of the Royal Air Force, as well as in all the operational commands, and of course the problems differed with the nature of the duties. The study of these problems, and the application of the results which were obtained from these studies, was continued throughout the war, in the fields of selection, prevention of inefficiency and neurosis in aircrew under training and in operational duties, and the treatment

and rehabilitation of those who broke down. Collected *Reports of investigations into psychological disorders in flying personnel during the war 1939 to 1945*<sup>1</sup> have recently been published by His Majesty's Stationery Office as Air Ministry Publication 3139. These reports contain much detailed information on many aspects of the subject which cannot be included in this short paper.

The management of psychological problems differed in detail in different forms of flying duties, so that I shall confine myself to one of these, and have chosen bombing. There are several reasons for this choice. In Bomber Command the problem was a large one—one third of all cases of neurosis in aircrew in the RAF occurred in Bomber Command, while very few men completed an operational tour in heavy bombers as completely fit men. They nearly all lost weight, had terror-dreams, or became jumpy and depressed. A very wise station-commander said that few of his men took their tour of night-bombing in their stride, and most of those who completed their tour only just managed to do so. Over 50,000 men lost their lives in bombing operations and only a minority of those beginning succeeded in completing their full operational tour of duty. Nevertheless, in this Command the issue was a simple one, for it involved the ability of a man to withstand persistent and repeated fear; other factors, such as fatigue or physical changes in environment played little part in the production of inefficiency or neurosis.

By the time a man had reached Bomber Command, selection had been undertaken, and the major problem was that of prevention of neurosis, for it was found that if, when a man had broken down under the stress of his duties, he required more than the most superficial psychotherapy, he was unlikely to return to flying-duty and to remain efficient.

### 1. Methods of Psychological Selection

Research into the most profitable methods of selection was undertaken throughout the war by the Training Research Unit and by the team of psychologists working under Professor Bartlett in Cambridge. Research had necessarily to follow two lines of enquiry, the first to determine aptitude for flying itself, and the second to distinguish the characteristics which safeguarded a man against the fears and stresses of operational flying. The first exercised the industry of a large group of workers, particularly in the United States, and it involved the construction and validation of aptitude-tests, some of them simple questions and answers, others complicated performance-tests such as the experimental cockpit used in Cambridge. As a generalization it is true that the more closely the test-situation resembled that within the aircraft, the greater was its reliability. Reid has recently shown in a follow-up of men who had reached night-bombing operations that there was a close correlation between performance in the Cambridge cockpit and efficiency in bombing operations, although a similar correlation of other tests was insignificant. A detailed description of the methods of selection which were devised, rejected, modified, applied and validated is far beyond the scope of the present short paper.

In the RAF initial selection was carried out by two parallel boards, one medical and the other executive, composed of senior officers who had flown. These boards

<sup>1</sup> Published by H.M. Stationery Office, London, 1946.

rejected those grossly unsuitable through physical shortcomings or ineptitude. It was during flying-training that the main selection occurred. At all stages the unsuitable were eliminated in the aptitude-testing which took place in the training aircraft, and flying-instructors—who often had considerable aptitude for the recognition of unsuitability—were instructed in the methods of selection. There was naturally a reluctance to lower the percentage of men passed out from any particular course, but, as the war progressed, instructors learnt that it was more profitable to reject the backward than to push them through. There was also the difficulty, which instructors in Flying Training Command sometimes had, of lack of personal knowledge of the conditions in operational flying. This prevented recognition of those personality-defects which militate against a successful career in operational flying.

A considerable advance occurred in the selection of bomber crews, when grading schools were instituted. In these schools all flying pupils flew under training in Tiger Moth planes for 12 hours. They were then graded on a system of marks which evaluated most aspects of the man's performance, and were selected for flying-duties as pilot, navigator or bomb-aimer. Late in the war, a much more elaborate system of vocational selection for the different aircrew duties was devised and put into operation, but as the time from the commencement of training to the end of a night-bomber tour was often over two years, the final validation of this system is not yet available.

## 2. Role of the Psychiatrist

Psychiatric selection—the examination by trained psychiatrists for evidences of handicapping personality-traits, and expert assessment of the personality—was not practised as a routine. There were several potent reasons for this. The first was a natural suspicion which the executive flying officers had towards doctors in general and psychiatrists in particular—a suspicion which gradually became less as the war went on. Then there was a quite justifiable feeling among flying personnel, that they were the best judges of the kind of men that they would trust in an aircraft. Lastly, there was the very material reason that the constant need for men was so great that no scheme of selection was admissible if it brought about the rejection of a significant proportion of the potentially successful for the sake of eliminating a small number of potential failures.

It was, therefore, incumbent upon the psychiatrists to prove that the results of their methods of personality-selection warranted their adoption. This was done, but again the time required for validation prevented any attempt to institute the methods in the machinery of routine selection. Psychiatric selection did occur, however, for, as had been mentioned already, not only were the unsuitable weeded out *ab initio* by selection-boards, sometimes with reference to psychiatrists, but re-selection boards employed a psychiatrist. During the months and years of training, selection continued, the doubtful or the neurotic being referred to the psychiatrist. In the later stages of training, when men were flying heavy bombers, the conditions began to approach those of operational flying, so that the natural selection which occurred was at that stage based upon personal aptitude for operational duties rather than for flying itself.

## 3. The "Harrogate Experiment"

The "Harrogate Experiment" was a large-scale attempt to validate methods of psychological and psychiatric testing against performance on night-bombing operations. This experiment was devised on the psychological side by Professor Bartlett, and on the psychiatric by Sir Charles Symonds, who used a method of scoring personality-traits based on the observations of R. D. Gillespie. The experiment was to take 1,000 men who had already been selected for flying-training, and who had completed their elementary flying-training, and subject them to an hour's psychiatric interview. This interview was carried out on 500 men each by two trained psychiatrists. They scored the presence of 10 personality-traits which had been found by Gillespie to occur in neurotic flying personnel, and made an independent psychiatric assessment, in four grades, upon the basis of the whole interview. The traits incriminated were:

1. A family history of psychiatric disorder
2. A previous personal nervous breakdown
3. Evidence of morbid fears and anxiety
4. Physiological instability, shown by such changes as fainting
5. Timidity
6. Lack of aggressiveness
7. Lack of persistence
8. Affective lability
9. Obsessional features, i.e., psychological immaturity.

The assessment of predisposition to neurosis was independently rated as none, slight, moderate, or severe.

The traits which related most closely to the psychiatric assessment of severe predisposition were: previous nervous breakdown, timidity, lack of aggression or of persistence, affective lability, and psychological immaturity. It was concluded that a method of elimination on the basis of assessment of predisposition might be practicable and profitable, but it would be neither practicable nor desirable to replace the psychiatric assessment by a trait-score. Subsequently, some of the tested men were followed through operational flying, and it was found that these conclusions were substantiated, but it was also found that the success of the method depended upon the personal flair of the psychiatrist for this work. Some details of the method are available in the collected reports already quoted.

## 4. Research in Bomber Squadrons

When a man had reached a squadron, the problem was then to maintain his efficiency in spite of the dangers and stresses to which he was subjected. The executive officers were mainly responsible for handling this problem, but as the war progressed they tended to call for psychiatric help. The necessity for such help was shown by the high rate of breakdown among aircrew engaged on operations. In the year 1942-43, 2,503 cases of neurosis in flying personnel were handled by neuro-psychiatrists, and 942 of these came from Bomber Command alone. Because of the necessity of recording the occurrence of neurosis in aircrew in different duties and circumstances, a central Registry was set up by the Consultant in neurology, Sir Charles Symonds. To this Registry each neuropsychiatric specialist made a card-return for every member of an aircrew referred to him with

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symptoms of a psychological disorder. The card contained fairly comprehensive data about the man's flying career, including his squadron, type of aircraft flown, duties, total flying-hours, and operational flying-hours, as well as an account of his illness, with a brief résumé of the main causal factors connected and unconnected with flying, and the treatment and disposal recommended. All the data were immediately transferred to a punch-card system, and the was possible to review contemporary events in this field with some accuracy. In this way conjecture was reduced to a minimum, and advice upon the management of aircrew could be based upon facts. The information obtained in this way led to a statistical survey of the situation in all commands, flying-duties, and squadrons in the RAF. This was reinforced by careful clinical studies of special problems as they arose, and by examination of groups of subjects representative of the whole group under survey. Some of the reports which were based upon this work are reproduced *in toto* in Air Ministry Publication 3139, already quoted.

Another method of study of the causes of inefficiency and neurosis in aircrew was that of personal field-surveys in the squadrons. In this work Sir Charles Symonds and I independently visited representative squadrons for each of the flying-duties undertaken in the RAF, and canvassed the opinions of commanding officers of stations, squadrons and flights, as well as of the medical officer, upon such subjects as the early signs of inefficiency and neurosis in flying personnel, the factors which they considered to be important in causing this inefficiency, and the methods which they thought should be adopted to reduce the incidence of neurosis. Some of the information obtained from the card-return is illuminating. The incidence of neurosis in different duties showed wide differences, as is revealed in the ratios (table I), expressed as an approximate percentage of average numbers of personnel for the year 1943:

TABLE I. PERCENTAGE INCIDENCE OF NEUROSIS FOR DIFFERENT DUTIES			
Night-bomber	...	...	12
Day-bomber	...	...	11
Day-fighter	...	...	6
Night-fighter	...	...	4
Coastal reconnaissance	...	...	3½
Training command	...	...	1

This table shows that there was a close relationship between the hazard of the duty and the incidence of neurosis arising in it. It shows that the incidence was 12 times as high in night-bomber squadrons as in Flying Training Command, although the number of psychologically-unsuitable men was, by natural selection, very much lower in the operational than in the training units, which underlines the part played by hazard in the etiology of the neurosis. In this respect it is interesting that the incidence in night-bombing squadrons was twice that in day-fighter squadrons. In Bomber Command, which was responsible throughout the war for one-third of cases of neurosis in flying personnel in the whole RAF at home and overseas, the incidence of neurosis in operational squadrons was about four times that of the whole service, over twice that in Fighter Command, and three times that in Coastal Command, while it was over 10 times that in Flying Training Command.

Furthermore, the incidence in operational squadrons in each command was many times higher than in training units within the command. It was clear that the most potent factor in causing neurosis in aircrews was fear. All other contributory factors added to the stress which the man had to withstand, but in the great majority of cases they were unimportant. The hazard of the duty, reflected in the wastage-rate in the squadron, was found to be directly and closely related to the incidence of neurosis. This is shown in table II.

TABLE II. RELATION OF NEUROSIS-INCIDENCE TO WASTAGE-RATE

Duty	Relative incidence of neurosis	Relative flying-hours per casualty in these duties
Night-bombing ...	12.0	160
Day-fighting ...	6.0	183
Night-fighting ...	3.4	231
Coastal reconnaissance...	3.3	360
Training ...	1.1	1,960

Fatigue was found to be of etiological importance in very few cases of neurosis, and physical causes apart from illness and injury were rarely considered contributory. This was in variance with views that were held early in the war, and at anoxia, altitude, or vibration and noise caused changes in flying personnel which predisposed them to psychological disorder. That the psychiatrists failed to recognize any such factors is shown in table III.

TABLE III. NEUROSES CAUSED BY FLYING-DUTIES

Recognized Causes	Number of cases (Total 2,200)	Percentage of Causes	Cases
Psychological (fear, etc.) ...	2,191	76	99.6
Physical injury	399	14	18.1
Physical illness	212	7	9.2
Air sickness	52	2	2.4
Exhaustion	43	1	2.0
Cold	0	0	0
Altitude	0	0	0
More than one cause	676	23	—

It will be seen that in virtually every case of neurosis there were psychological causes recognized as playing a major part in the etiology of neurosis in aircrew, while in 2,200 cases physical factors specially encountered in aircraft—cold, anoxia, altitude—were never thought to have played any significant part.

## 5. Fear

The field-survey in the squadrons led to the same conclusions as the statistical survey—that the most potent cause of inefficiency and breakdown in aircrew was fear. Strenuous attempts were therefore made to limit fear, in its intensity, its duration, and its repetition, and to modify the circumstances in which it arose. Many lines of approach were open, and as many as possible were used. First, there was the attempt to encourage the development of fortifying factors in the men exposed to fear. This entailed encouragement of the right kind of leadership in the flight- and squadron-commander's development of the group-spirit in the station, particularly in respect to the

which subjects take in them and not to any increase in capacity, since similar improvement may be produced by other means which increase interest. For instance, a similar reduction of errors in a pursuit-meter test may be obtained by causing the subjects to regard a trial as of more than normal importance, or by providing special incentives. In tests in which speed and accuracy may vary, these measures have a less-uniform effect than amphetamine, since they may make a subject either more careful or more rapid in his work, whereas amphetamine nearly always causes an increase in speed and not in accuracy.

### Disadvantages of Analeptics

This account suggests that the effects of amphetamine are highly desirable, but there are several sources of danger, which make it unwise to use amphetamine except in special circumstances and with safeguards. In such experiments as I have described, subjects are given a task to perform, and changes in their performance are regarded as favourable within the particular test situation. Whether the effects appear desirable or not depends largely on the situation in which a subject's activity is observed, and the subject who has taken amphetamine usually judges the effects more favourably than the experimenter. For instance, an increase in speed with only a small loss of accuracy may be regarded as a favourable effect in a test-situation in the laboratory, but would not be so regarded if the subject were driving a car in everyday circumstances. Similarly, the way in which a task holds the attention may be favourable in terms of test-scores, but may lead an individual to persist inappropriately in activities which are not rewarding. For instance, a research colleague, left to his own devices after a dose of amphetamine, spent a morning preparing with great thoroughness a grandiose research-plan, of which he would never find time to carry out even a quarter. Moreover, the tests in which favourable effects may be observed provide subjects with scope for their energies and allow a considerable degree of success. The effects are less favourable if this is not so, or if activity is more constrained by the test-situation. Then impulsive and inappropriate activity is often observed, and subjects tend to become irritable and restless. When one activity competes with another, and separate responses have to be made to more than one stimulus at much the same time, the effects of the drug tend to be unfavourable and behaviour disorganized.

## PSYCHOMOTOR EFFECTS OF ANALEPTICS AND THEIR RELATION TO "FATIGUE" PHENOMENA IN AIR-CREW

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In some experimental subjects a dose of 15 mg. amphetamine may produce striking changes in the performance of psychomotor tests. In several of the tests by which we try to measure the effects of such drugs as amphetamine, both the speed and the accuracy of the performance may vary. Amphetamine produces an increase in speed with some, but not a proportionate increase in errors. In tests in which speed does not vary, like the pursuit-meter, errors may be reduced in number. When subjects are kept awake all night, a deterioration of the performance both in speed and accuracy may be observed during the night and the following day. Amphetamine may partially restore the performance. With a dose of 15 mg., subjects may feel more alert than usual and ready for anything. They may become mildly elated and confident, without the doubts and anxieties and the discomfort of the tension usually experienced before starting a test. On the other hand, tests which without amphetamine are regarded as boring may engage their interest and become absorbing. They may feel able to concentrate on them without the usual diversion of their attention by extraneous events. Attention may seem to be narrowed and focussed upon the task in hand. If they have been deprived of sleep, amphetamine may remove the desire for sleep and the associated feelings of heaviness and listlessness. It is probable that the improvement in the performance of tests with amphetamine is related to the greater interest

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The realization of the importance of personal predisposition to neurosis emphasized the potential value of psychiatric selection, and sufficient data are now available to show the actual value of such a procedure. In the urgent circumstances in which aircrew were recruited and trained in the earlier part of the war, it was impossible for the trained psychiatrists available to interview more than a minute fraction of the intake. An important lesson of the war has been that, if psychiatric selection of aircrew is to be successful, the selecting psychiatrists must themselves be selected for their aptitude for that particular task, for diplomas and success in other fields of psychiatry are not enough.

To restore balance to this sketchy survey of the psychiatric problems in aircrew in Bomber Command, it must be asserted that the important work in this field took place on the airfields themselves. And it was carried out by the commanders of flights, squadrons and stations, with the valuable help of squadron and station medical officers. These men, by constant contact with the dangers of operational flying and with the effects of these dangers upon aircrew, learnt much about the psychiatry of fear, and applied all they knew.

reasons for it. These facts were established (Davis, 1946, and in press):

- i. If in an individual case disorganization of skill occurred, it occurred relatively quickly and was definite at the end of 20-30 minutes. If at the end of 45 minutes an individual was maintaining a high standard of performance, he would continue to do so for several hours, much longer than the time for which the test usually lasted.
- ii. If skill became disorganized, the effects showed two phases. In the first phase, there was an increase in the force and extent of responses to deviations of instruments from prescribed readings and an increase in inappropriate, restless movements. In the second phase, activity was reduced and insufficient.
- iii. Disorganization of skill was associated with emotional disturbance. In the first phase, subjects were irritable, excited and anxious, in the second phase apathetic and discouraged.
- iv. The degree and type of disorganization was dependent upon the grade and type of predisposition to neurotic breakdown under stress, as assessed at an independent psychiatric interview.
- v. A similar disorganization of skill may be produced in simple test-situations, when stimuli are of short duration and when fatigue could not be present.

From these facts it was concluded that in the experimental analogue of flying, disorganization of skill was not determined primarily by prolongation of the test, but was due mainly to the anxiety provoked by the test. Other experiments indicated that, in the case of the cockpit-test, anxiety was due to the difficulty experienced by predisposed subjects in attaining a satisfying standard of performance. The machine was very unstable, and excessive activity was penalized heavily. These characteristics made some subjects feel insecure, particularly if they aspired to a high standard of accuracy. It was concluded that the general conditions of disorganization of skill are factors in the environment which signify danger and evoke in the subject anticipatory tension, the subject not having the means of removing the danger and thereby relieving the tension.

#### Direct Observations

These results agreed with the results of investigations carried out by a branch of the Medical Directorate of the RAF. From conventional views on fatigue it would be expected that, as the length of flights increased, so accidents would become more common. Professor Bradford Hill and Wing-Commander G. O. Williams overcame the difficulties of comparing the incidence of landing-accidents with different lengths of operational flights, and showed that, contrary to these views, landing-accidents were not more frequent after long sorties than after short ones, with the possible exception of flights of more than 10 hours.

Similarly Squadron-Leader D. D. Reid showed that, in the air, errors by navigators, whose efficiency was more easily assessed than that of pilots, did not become more frequent with the length of time at the job. On the contrary, the peaks in the incidence of errors corresponded to the times at which emotional stress was likely to be at its highest, as, for example, when crossing the well-defended areas near the coast of enemy-occupied territory.

Reid also showed that the incidence in aircrew of acute neurosis, which is sometimes said to be due to fatigue, was correlated relatively highly with measures of the hazard under which sorties were flown. It was not correlated, however, with the number of sorties or the amount of flying within a given period, as would be expected if "fatigue" was an important factor in the causation of such neurosis.

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Both series of investigations incriminated stress and the resultant anxiety, rather than prolongation of work and fatigue, as the conditions under which errors are made. Many of the arguments, by which the use of amphetamine by aircrew is justified, are therefore irrelevant. It is, then, not sufficient only to study the effects of amphetamine or other remedies. One must learn something of the reasons for the human failings, which such remedies are said to prevent. Studies of the disorders of skill are still being pursued in this laboratory.

#### REFERENCE

Davis, D. R. (1946) *J. Neurol. Neurosurg. Psychiat.* 9, 23

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reasons for it. These facts were established (Davis, 1946, and in press):

i. If in an individual case disorganization of skill occurred, it occurred relatively quickly and was definite at the end of 20-30 minutes. If at the end of 45 minutes an individual was maintaining a high standard of performance, he would continue to do so for several hours, much longer than the time for which the test usually lasted.

ii. If skill became disorganized, the effects showed two phases. In the first phase, there was an increase in the force and extent of responses to deviations of instruments from prescribed readings and an increase in inappropriate, restless movements. In the second phase, activity was reduced and insufficient.

iii. Disorganization of skill was associated with emotional disturbance. In the first phase, subjects were irritable, excited and anxious, in the second phase apathetic and discouraged.

iv. The degree and type of disorganization was dependent upon the grade and type of predisposition to neurotic breakdown under stress, as assessed at an independent psychiatric interview.

v. A similar disorganization of skill may be produced in simple test-situations, when stimuli are of short duration and when fatigue could not be present.

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Furthermore, although, by administering 15 mg. doses, the effects which I have described may be obtained in about half of a group of healthy subjects, less-desirable consequences may follow in the other half. Individual differences are large and unpredictable, and the effects differ in the same individual from occasion to occasion. Sometimes individuals become excited, restless and garrulous. Some become irritable and quarrelsome, others emotionally labile. For instance, a normally well-balanced girl carried out a psychomotor test after a 15 mg. dose. She started brilliantly, and it seemed probable that she would beat the laboratory record. She made a few unlucky errors, however, burst into tears, and was quite unable to complete the test. Irresponsible behaviour, euphoria and airy, dreamy, or drunk feelings may also result from a 15 mg. dose. Undesirable bodily effects, such as tachycardia, precordial discomfort, headache, giddiness and nausea, are also relatively common.

I have described the effects of a relatively large dose of amphetamine, because it is necessary to administer a dose of this size, if by present methods satisfactory observations of the effects on performance are to be made. The effects of 5 mg. and 10 mg. cannot be described so definitely. The desire for sleep, however, is appreciably reduced even by 5 mg. The same dose, or 10 mg., may produce definite changes in feeling-tone, but changes in test- and other behaviour, are not often observed. On the whole, the desirable effects are more prominent than the undesirable, but even with these doses the undesirable effects are not negligible.

The Germans explored the military use of analeptic drugs such as amphetamine and desoxyephedrine ("Pervitin") before 1939, and at first their reports were favourable to its use. Desoxyephedrine was used fairly widely both by German soldiers and civilians at the beginning of the war. In Britain, systematic research into their military use was started in the summer of 1940, and was continued fairly intensively for about two years. Since then research in this field has been desultory. Even in 1940 there was an extensive published literature dealing with the effects on the behaviour of healthy individuals, but then, as now, it is founded with contradictory findings in respect of important tails. Relatively large laboratory- and field-trials of and of the reports in the literature, it was concluded that the favourable effects of the drug did not generally outweigh the dangers, and widespread usage of the drug is strongly discouraged. A limited use in special circumstances in order to reduce the desire for sleep was hardly allowed. Thus, a small dose (e.g. 5 mg. amphetamine) may be administered on occasions, but not as a means to drivers who have to travel a long distance at night, but who are not adequately trained. In other circumstances, larger doses may be administered for the sake of the mild elation produced by the drug.

I am sure that this policy was correct, and I think that those responsible for it would make little change in it now, although the perspective in which these matters are seen has changed considerably in the interval. Personally, I would place more emphasis now upon the fact that the benefits claimed for the drug are obtained by training and by other measures which lead to good morale. Also the

### Experiments on the Causes of Errors attributed to "Fatigue"

Let us now consider the case for the administration of amphetamine to pilots and other aircrew, when they are engaged upon a lengthy flight. Actually, analeptic drugs were officially banned for aircrew, except in rescue-conditions, because of the danger that doses sufficient to be beneficial might be baldly paraphrased thus: "A long flight is fatiguing, and aircrew become more liable to make mistakes as they become fatigued. Amphetamine may sustain them and reduce the number of mistakes due to fatigue. Fatigue may be likened to a fire burning dim, because it is choked by ashes, the products of its metabolism. Amphetamine acts like a bellows."

This argument is a misguided one, because it assumes that an important cause of mistakes by aircrew is fatigue, whatever fatigue may mean. The indiscriminate use of this term is indeed a source of confusion which has retarded the solution of a number of practical problems of the kind which we are now considering. One may dispense with the term, however, and ask under what precise conditions errors occur. Two independent lines of investigation pursued during the war provided approximate answers to this question. These I shall now describe very briefly.

### The Cockpit Experiments

At the beginning of the war, a new approach to the problem of so-called "pilot-fatigue" was made possible by the development by the late Dr. Craik of an apparatus which is now called the Cambridge Cockpit. This ingenious apparatus provided the means of analyzing in detail the performance of pilots engaged in an instrument flying-exercise. The Cambridge Cockpit was something like a Link trainer, but it was stationary and included devices by which detailed graphic records were obtained of the movement of instruments and controls.

Since the control of the machine was difficult and the exercises were prolonged, it was expected that the skill of the pilot-subjects would become gradually disorganized. This proved to be the case. It was no explanation of the disorganization to attribute it to fatigue, however, and further experiments had to be carried out to discover the

## WARTIME INVESTIGATIONS INTO SEA- AND AIRSICKNESS

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In 1914, shortly after a raiding party—Commandos as such people were beginning to be called—had set out to raid the Lofoten Isles, the expedition ran into bad weather, and the ships had to delay to effect repairs. In the opinion of some on board, the necessity for repairs was providential for, had it not occurred, the seasickness of a large number of the Commandos would have seriously hampered the expedition. Fortunately for the success of the operation, the stormy weather had subsided by the time the repairs were completed, and the seasickness abated.

However, the warning that seasickness might prove a hazard in air-sea-land operations was heeded, and the search for an effective seasickness remedy began. Previously the Flying Personnel Research Committee had instituted a programme of research into the prevention of airsickness, and together with the Military Personnel Research Committee similar research into seasickness was undertaken. The problem was tackled by teamwork, and it is impossible to state where one person's work began or ended. Laboratory work was carried out in Dr. E. A. Carmichael's department at the National Hospital, Queen Square, London, and at the National Institute for Medical Research at Hampstead, and much work was done in the field with the co-operation of the three fighting services. Major J. A. Magladery, R.C.A.M.C., Dr. G. L. Brown, and Dr. B. McArdle originated work in the laboratory (using a large swing to produce motion-sickness). Dr. McArdle, joined by Surgeon Lieutenant-Commander Holling and Major Trotter, carried on the investigation at sea, Major Magladery and Squadron-Leaders Joeke and Parkes continued investigations pertaining to airsickness. Major Clifford Wilson carried out field-trials of the effects of certain drugs used on military efficiency. Dr. Harold King and Dr. H. Mackintosh advised on pharmacological questions, and Professor Bradford Hill gave invaluable co-operation throughout in the statistical evaluation of results.

When time is not important, it would be possible to deal with those susceptible to motion-sickness either by habituating them to the actual motion or by gradually eliminating them from the combatant unit. This could not be done in 1941, because it was necessary to train large numbers of landmen, and only few planes, gliders and landing-craft were available. At this time Major Magladery suggested that the use of a swing might provide a useful means of testing the susceptibility of the men to motion-sickness, of immunizing them to its effects, and of studying the problem of motion-sickness in man and in animals under laboratory conditions.

A swing was accordingly built (fig. 1) and was found to be successful in reproducing the symptoms of sea- and airsickness; so it seemed that the necessity of having to wait for suitable weather, available craft and co-operative men to be all together at the same time could be avoided. The swing was simple both to construct and to manipulate, and in practice proved to be as capable of producing motion-sickness as any of the more complicated means which have since been devised. The relationship between swing-sickness and air- and seasickness was examined by finding whether men susceptible to the motion of a swing are equally susceptible to the motion of an aeroplane or ship. Unfortunately it was found that swing-sickness could not be regarded as identical with either seasickness or airsickness, for the same man might be sick on the swing and not on the sea, or sick on the sea and not sick on the swing. It was found that a considerable proportion of men susceptible to swing-sickness was also susceptible to sea- and airsickness, but it was clear that to use a swing-test as a means of eliminating potential sea or air sufferers would be too wasteful of men. It was

FIG. 1. SWING FOR REPRODUCING SYMPTOMS OF SEA- AND AIRSICKNESS



also found that, to use the swing as a means of immunizing susceptible subjects to the effects of motion, though it could be done in some subjects, was too doubtful and time-consuming a method to be generally recommended. So it was that the swing offered no immediate practical application to the reduction of motion-sickness, but did, however, enable workers to advance our knowledge of the pathology and therapy of the condition.

It was found possible to record the contractions of a subject's stomach whilst he was actually being swung. This was done by letting him swallow a balloon attached to a recording device by a long length of rubber tubing. In this way it was possible to show that the stomach four hours after a meal shows slow rhythmical contractions with the effects of respiratory activity superimposed on them. When swinging starts in a susceptible subject, the rhythmical activity ceases, and the intragastric pressure falls as the subject becomes nauseated. These effects, together with the decreased amplitude of the respiratory excursions, continue for some time after swinging has ceased, while the subject lies on the swing feeling miserable. This atony of the stomach has also been seen radiographically in susceptible, but not in immune, subjects. Tight binding of the abdomen is not successful in counteracting it, and though intravenous injection of 0.5 mg. prostigmin and 0.4 mg. atropine causes powerful hunger-contractions and increased gastric tone in resting subjects, it fails to prevent the fall of gastric tone when a susceptible subject is swung, and moreover, it has no specific effect in preventing motion-sickness.

Manning & McIntyre (1943), as a result of experiments on the swing, have presented evidence to show that the position of the head relative to the resultant of the forces involved is an important factor in determining the development of swing-sickness. When the resultant of the forces involved acts perpendicularly to a line between the outer canthus of the eye and the auditory meatus, the incidence of swing-sickness is high, but when the resultant force acts parallel to this line the incidence is low. These findings may prove to be of value in the prevention and nursing of those suffering from motion-sickness.

Other experiments suggested that nausea caused by the swing had a slight effect in reducing performance on a "psycho-motor" testing machine designed by Dr. Schuster. This effect, however, was of short duration.

Transatlantic workers have furthered the study of swing-sickness, particularly in animals, by cortical-ablation experiments and the recording of action-potentials from various parts of the central nervous system as the animal is being swung. Others have used the method in the search for newer and better drugs in the treatment of motion-sickness.

### Sea-Trials

As it became established that neither the swing nor any other available measure could serve as an effective means of eliminating susceptible personnel from sea- or airborne operations or of accustoming the participants to the incidental movements, it became obvious that drug therapy as a means of reducing motion-sickness would have to be considered. At that time, 1941, no one knew enough to say which of the many remedies recommended as certain cures of seasickness could be given to combatant troops with the possibility of doing any good and the certainty of doing no harm.

Hyoscine has always been used in the treatment of seasickness, but the state of knowledge in 1941 was that hyoscine was only one of many recommended remedies; for example, if one judged by the reports in the literature there was nothing to choose between hyoscine, chloral, chlorotone, amytal, apomorphine, syntropan, amphetamine, ergotamine, ammonium chloride, glucose or numerous other remedies. Subsequent observations showed that these latter drugs had little or no beneficial action on motion-sickness. It was not, even in 1941, generally held that seasickness might be controlled by drugs, for some enthusiasts pinned their faith to a belladonna plaster applied to the abdomen; a constricting band to the neck, chest, or belly; a device to keep the head in one plane; or some, more understandably, to a régime of stout, neat brandy, iced ginger-ale or sips of iced champagne; it has always been regretted by the observers that the inapplicability of these last measures to combat troops prevented a trial of them being carried out!

To those who know the difficulties of getting trustworthy answers from trials requiring the administration of drugs to military personnel, it is very understandable that misleading reports of the efficacy of sea- and airsickness remedies should have appeared. The peacetime ship's surgeon is not in a position to treat his patients as experimental subjects and consequently cannot carry out trials under conditions which permit of scientific control. Nevertheless in the literature of seasickness there were occasional papers which seemed to give trustworthy information of which drugs might be worth trial. Such recommended drugs were either sedatives or drugs of the belladonna group. When the time came to select drugs for trial, it was deemed advisable to include proprietary drugs because there were claims that the synergistic action of the constituents of certain proprietary formulæ caused them to be more efficacious than the total separate actions of the constituents. No reliable evidence of this synergism has been obtained.

Though some indication of the efficacy of the remedies on trial might be derived from a study of their effect on swing-sickness, for a true assessment it was necessary to carry out trials at sea and in the air. For this purpose it was necessary to find vessels which would be permitted to go to sea in rough weather, and this appeared to preclude landing-craft. This was unfortunate, because it is always desirable for an investigator to have first-hand knowledge of all aspects of the problem he is investigating. As an example, one may cite the finding of Major Magladeroy of the adverse effect of having to crouch to look out of the porthole of a glider, and the subsequent finding by Jowett & Thomson (1943), and Tyler (1946), that the elimination of excessive crouching in landing-craft reduced the amount of sickness.

However, eventually mine-sweepers working from Falmouth were the craft used to study seasickness. When the weather was rough, the minesweepers could not carry out their normal duties, and were willing to make special trips to sea for the benefit of the investigation. The majority of men enjoyed the trips, even though they might be sick, for a sea trip was a pleasant change from the intensive training they were undertaking at the time. Moreover since the men embarked with an air of secrecy carrying martial weapons, they were sometimes mistaken by onlookers for a commando raiding party, a mistake which pleased the men.

During the period of sea trials a party of 70 men embarked in two minesweepers whenever there was a prospect of rough weather. One hour before embarkation, each man

received either one of the drugs being tested or a dummy tablet. Tyler has subsequently shown that the incidence of sickness in military subjects is not significantly different whether they are given a placebo or not—indicating that the psychological effect of a placebo is negligible in such instances. Every precaution possible was taken to ensure that the drugs were in every case swallowed by the men, and though on occasions a pill was spat back into the drinking-mug used, most of the tricks to avoid taking a pill had been foreseen and prevented. The distribution of the remedies was planned to ensure a random distribution amongst the soldiers of the dummy tablets and the drugs under test. The trips to sea lasted up to 6 hours and the men had free range of the ship, though they usually preferred to remain on deck.

At least one observer sailed with each ship. He kept a record of the trip, including a note of the type of motion encountered, but his main purpose was to talk to the men individually and to observe and record the onset of any sickness. In this way, occasional cases of nausea which had escaped observation were brought to light. In very rough sea, up to 40 % of the men on board were affected, and trips in which little or no sickness took place were not included in the series. In an attempt to grade the severity of conditions in the different trips, records were made with instruments designed to record the frequency and extent of the ship's movements. These were not satisfactory, and it was concluded that the most practical method of measuring the severity of a ship's motion was to use the incidence of sickness occurring in the group which had received only placebos.

### Results

In estimating the effects of the remedies, both those who had vomited and those who had experienced nausea were included in the description "sick". The diagnosis thus rested mainly on a man's own statement, but was usually confirmed either by seeing him vomit or noting his haggard look and greenish pallor, for the observers quickly became skilled at recognizing the early signs of seasickness. Nauseated subjects were included as sick because, on short cross-channel trips, nausea alone might be just as incapacitating as vomiting. Moreover, the fact that the majority of those nauseated had vomited by the end of the trip suggests that vomiting may be regarded as an incidental symptom likely to occur sooner or later in a nauseated subject. It is of course true that, on long voyages, continued vomiting causing loss of food and fluid may exhaust the sufferers, but it was considered that for military purposes nausea was just as undesirable as vomiting.

The results of early trips in which proprietary remedies were used are shown in table I.

The final column of the table gives a figure which enables a rough comparison to be made between two drugs, even though one might have been used on a rough trip and one on a comparatively smooth trip. It estimates the number who were saved from being sick by the effect of the remedy, and is expressed as a percentage of the total number of those who would have been sick if no drug other than a placebo had been given. Thus when Remedy C<sub>1</sub> is under consideration, 34 % of the controls were sick, but only 16 % of the treated. It is assumed that 34 %—16 %, i.e., 18 % of all men

TABLE I. RESULTS OF USE OF SEASICKNESS REMEDIES

Drugs	Trips	Number of controls	% Sick	Number of treated	% Sick	% Susceptibles protected
Remedy A	1-7	83	22	78	22	0
Remedy B	1-7	83	22	75	25	0
Remedy C <sub>1</sub>	1-10	141	34	129	16	53
Remedy C <sub>2</sub>	13-17	86	38	91	37	3
Methedrine (8 mg.)	1-7	83	22	77	22	0

$$\% \text{Susceptibles protected} = \frac{100(\% \text{sick in control-group} - \% \text{sick in treated group})}{(\% \text{sick in control-group})}$$

receiving C<sub>1</sub> were protected, so that 53 %, that is  $\frac{18}{34} \times 100$  of those who would otherwise have been sick were afforded protection. This figure gives only an indication of the order of efficiency of a drug, and is not an exact statement. It would be invalidated in comparing remedies used on trips of different roughness, if it were subsequently found that the efficacy of a drug varied with the severity of conditions. It was used in order to be able quickly to reject remedies which did not appear promising.

From these results it appeared that remedies A (containing chloretone), B (containing syntropan) and methedrine (equivalent pharmacologically to amphetamine) showed no significant effect in preventing seasickness. C<sub>1</sub> (containing hyoscine) showed a significant effect in preventing seasickness, but a second sample of the same remedy C<sub>2</sub>, which the makers said was identical with the first sample, was found to be without significant effect. Fortunately it was the first sample which had shown effects, so that the observers were encouraged to search for the active principle.

Table II shows all the remedies tested in this series arranged in the approximate order of their efficacy :

TABLE II. SEASICKNESS REMEDIES TESTED, ARRANGED IN ORDER OF EFFICACY

Drug	% Susceptibles protected
Hyoscine 1.2 mg.	73
Hyoscine 0.6 mg.	57
Remedy C <sub>1</sub> (hyoscine + hyoscyamine)	53
Atropine 1 mg.	40
l-Hyoscyamine 0.96 mg.	40
d-Hyoscyamine 2 mg.	25
Homatropine 2 mg.	25
Phenobarbitone 1 grain [66 mg.]	18
Sodium hydantoin 0.2 g.	8
Remedy C <sub>2</sub> (? composition)	3
Remedy A	0
Remedy B	0
Hexobarbitone (evipan) 10 grains [660 mg.]	0
Methedrine 8 mg.	0

It is obvious from this table that drugs of the belladonna-scopolamine group have a significant effect in preventing seasickness. Statistical analysis of the material shows that the evidence is also very suggestive that hyoscine (especially in the dosage of 1.2 mg.) is more effective than hyoscyamine or any similar drug. Subsequent work, in particular by



Hill & Guest (1945) in India, and Tyler (1946) in California, who actually made use of assault-craft, has confirmed these findings. The effect of the remedies has also been observed on longer trips to sea, and it has been found that hyoscine given in an original dose of 0.6 mg. can be repeated in doses of 0.3 mg. at intervals of 6 hours without the appearance of obvious side-effects.

The observers on airsickness have found it very difficult to obtain comparable figures; this is largely because of the impossibility of accommodating sufficiently large groups of men in aeroplanes to subject them to the same conditions at the same time. Such figures as there are indicate that, although hyoscine is effective in preventing some airsickness, its value is not as great as in seasickness.

Other remedies have been developed by the RAF, the Royal Canadian Navy, and the American Army. All three of these remedies contain a number of drugs and include hyoscine. The general opinion at present is that there is nothing to choose between hyoscine itself and any of the more complex remedies containing it, but that no known remedy will protect every person in all weathers.

In general, careful observers of motion-sickness occurring in military personnel have not been impressed by the evidence that psychological factors play any significant part in the genesis of true motion-sickness: in military subjects air- and seasickness appear to be almost wholly a function of the physical conditions present at the time.

From table II it will be seen that phenobarbitone appeared to have some protective effect. The investigation of this and similar drugs was not pursued at the time because it seemed that the belladonna-scopolamine drugs were so much superior, but Tyler (1946) has subsequently confirmed this observation of the beneficial effect of some barbiturates and has shown that they are effective only when conditions are moderate. Independently, Canadian workers have pursued this investigation of barbiturates, and the public announcement of their findings is awaited with interest. Whether a barbiturate more effective than hyoscine is discovered or not, the combination of barbiturate and hyoscine should be considered for civilian use, since a possible hypnotic effect of barbiturate, however undesirable in military use, might be welcomed in civilian practice.

The only unpleasant side-effect of the use of hyoscine in these doses was the occasional complaint that the dryness of the mouth made mastication difficult. This side-effect was still more marked with hyoscyamine; recent work having shown that, weight for weight, hyoscyamine depresses salivation five times as much as hyoscine. No drowsiness and no effect on visual accommodation was found, and no evidence was found that hyoscine in these doses had any effect on military efficiency; indeed there are reports that hyoscine may slightly improve shooting-performance.

#### The Use of Seasickness Remedies on Active Service

Though seasickness remedies were used on D-day in Italy and Normandy, it has proved extremely difficult to obtain authoritative reports of their effect when used in actual operations. This is because, in such circumstances, the observer is confined to a small group—one glider, landing-craft or aeroplane—and has more important matters to attend to. Good and bad reports have been received, but it is mostly the bad ones that have been published; the *Daily*

*Express* quoted a War Office Brigadier as stating that D-day had resulted in the greatest mass vomiting ever known in the history of mankind. At the same time the late Ernie Pyle, the American war correspondent, reported that the result of taking the official seasickness remedy was almost to kill him.

"The capsules," he reported, "have a strong sleeping powder in them, and by noon all the Army personnel aboard were in a drugged stupor. The capsules not only put us to sleep, but they constricted our throats, made our mouths bone dry, and dilated our pupils until we could hardly see. When we recovered from this insidious jag, along towards evening we threw all our seasickness remedy away, and after that we felt fine."

Then he adds, somewhat illogically for his castigation of the remedy, "Although the Channel crossing was rough, I didn't hear of a single man aboard who got sick." It appears that Ernie Pyle and his companions had taken at least twice the official dose. His story, nevertheless, brought criticism of the authorities who could allow the administration of such drugs.

This is one of many reasons why one should consider whether it is advisable to undertake routine administration of seasickness drugs to troops engaged on combined operations, since, whether it is effective or not, the drug is liable to be blamed for any subsequent mishaps. Again, the effect of seasickness of comparatively short duration may be considerably overrated, for healthy men virtually make a complete recovery from the effects of seasickness within a quarter of an hour of the cessation of the causative motion, and general experience of manoeuvres with landing-craft exercises is that the men have recovered by the time the actual landing takes place. The experience of the navy is that it would be preferable to reserve the drugs to be given under medical supervision on the few occasions when circumstances warrant it, otherwise relying on the habituation of trained men to counteract any susceptibility to motion-sickness. Should habituation not develop, it would be preferable to remove men who are permanently susceptible from such duties, rather than that they should have to rely on a drug.

#### Further Outlook

The above consideration of the military value of seasickness remedies does not imply that the search for a remedy has been of no avail. The doctor, whether civilian or military, who is called upon to treat motion-sickness, will welcome the knowledge that remedies containing hyoscine are most likely to be effective, and in the swing we have an easily assembled piece of apparatus for the production and investigation of one type of motion-sickness. Further study of its effects may be expected to increase our knowledge of the physiology of the labyrinth, of body-righting reflexes, of nausea and vomiting, and perhaps to indicate methods of controlling them more effectively.

The belladonna-scopolamine alkaloids offer a field for search for an alkaloid which will have the effect of preventing seasickness, but which will not cause mouth-dryness. So far, experiments in this direction have not been energetically pursued. The demonstration of the value of the belladonna and scopolamine alkaloids leads one to wonder why they should be effective. So far as our knowledge goes, they do not appear to be general cerebral depressants in the doses

*Continued at foot of page 59*

## WARTIME PROBLEMS OF GLARE AND DAZZLE

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Problems of glare and dazzle during the war can be roughly classified into three groups concerned with (i) devices to protect the eyes from excessive natural light, (ii) dazzle from gunflash, searchlights, etc., (iii) dazzle as an offensive or defensive weapon.

### 1. Protection from Excessive Natural Light

In the protection of the eyes against excessive natural light, the problems are not essentially different from those in peacetime, but there are some special military aspects which call for particular attention. The anti-aircraft gunner who has to scan the neighbourhood of the sun, on the lookout for aircraft, which frequently attack down sun. It is not enough to look at the sun with the naked eye, but any device which enables one to look at the sun inter-  
mittently with the efficiency of scanning in other parts of the field. The late Dr. Craik (1943) examined a whole range of different filters, neutral and coloured, of different densities, and tested the range at which aircraft could be seen from the observer, just disappeared from sight under daylight conditions. His results indicated reductions

of range by the use of the filter, varying from about 5% reduction for a filter of 30% transmission, to about 20% for a filter of 5% transmission. These values referred to neutral filters and to brightnesses of 500 to 1,500 equivalent foot-candles<sup>1</sup> corresponding to regions of the sky not particularly near the sun. Orange or red filters had less effect on range.

As regards comfort in use (assessed partly by blink-rate), all the filters were found to be an improvement on the naked eye, the denser filters being most favourable. Gilded filters were found to be particularly good, possibly on account of reflection of the infra-red radiation, but heat-absorbing glasses were not outstanding. Craik found that the reduction of field-size produced by goggles had an important effect in improving comfort.

Another factor to be considered was the possibility that a filter which reduced the visual rays entering the eye might, nevertheless, pass sufficient heat-radiation to cause damage to the retina. That such damage can occur we know from cases of damage by scanning near the sun, not under eclipse conditions.

For anti-aircraft gunners it was necessary (a) to sacrifice some sighting-range to help scanning near the sun, and (b) to avoid any danger of retinal damage. It was decided to use a rather deep green protex glass with a visual transmission of about 9% and a total heat transmission of 0.6%. For general ground-duties under sun-glare conditions, and for aircrews, tropex or Crookes B2 with visual transmission in the range 12 to 26% were specified. Latest air trials in India suggest that 15% transmission is the most satisfactory value for these duties. As the ratio of the light-transmission to the total heat-transmission is an indication of the margin of safety of a glass against retinal damage by heat, it may be of interest to give the ratio for the glasses mentioned:

$$\frac{\text{Light-transmission}}{\text{Heat-transmission}} = \frac{15.0 \text{ (protex)}}{0.6 \text{ (Crookes B2)}}; \frac{1.6 \text{ (tropex)}}{0.6 \text{ (Crookes B2)}}$$

The filters so far mentioned were uniform filters which could be fitted in any standard goggle or sun-spectacle,

<sup>1</sup> [1 foot-candle = 10.76 metre-candles; 1 equivalent foot-candle = 10.76 equivalent metre-candles.—Ed.]

### WARTIME INVESTIGATIONS INTO SEA- AND AIRSICKNESS

*Continued from page 49*

given, for if this were the cause of their action one would expect barbiturates to be more effective. Their action on the stomach does not appear to be directly implicated, for atropine is more active than hyoscine in this respect and yet has a lesser effect in relieving seasickness, and whilst the atropine-prostigmine mixture mentioned above was more effective than atropine alone in increasing gastric tone, it has not proved any more successful as a motion-sickness remedy. Nor does hyoscine appear to act by depressing the vomiting-centre or its efferent paths, for it was found that hyoscine has no marked effect in preventing the vomiting caused in man by intravenous injection of the minimal emetic dose of apomorphine. It may be that hyoscine acts by suppressing discordant impulses arising in the labyrinths and muscles and joints, but this possibility requires investigation.

It has also been remarked that the belladonna drugs effective in seasickness are also effective in parkinsonism. This disease

offers an opportunity to study the effect of different belladonna-scopolamine-like drugs in the hope that one may be found which will free the rigidity of the muscles and yet not cause mouth dryness or paresis of the accommodation. If such a drug were found it might well prove to be more effective than hyoscine in seasickness. This suggestion for improving our knowledge of seasickness remedies is put forward because under conditions of peacetime practice it will be difficult to continue adequate clinical investigations into the therapy of the condition of sea- and airsickness.

In conclusion it is necessary to apologise to certain Canadian and American research workers whose valuable work on motion-sickness during the war years has not been given recognition here. Report on this work has been omitted because it has been available only in documents which come under the wartime category of "Restricted".

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but there were many attempts to provide protection against excessive natural light by special devices. The simplest of all perhaps was the snap-down visor, a filter of low transmission fixed to the goggles, which could be brought into action for short periods at will. Another scheme was the use of a pair of superimposed polarizing filters which could be rotated, one with respect to the other, so that the amount of transmitted light was variable from a very high to a very low value. Heat-absorbing filters with a small blacked-out or very dense dot on the line of sight of each lens, arranged so as to occlude the sun's image, were also tried. In another device of the same kind, the two blank dots were replaced by a vertical bar and a horizontal bar on the lenses of the two eyes. In the binocular field this produced a cross, at the central intersection of which the external field was completely occluded for both eyes.

While all these devices had their advocates and critics, none of them represented a complete solution to the military problem.

## 2. Protection against Dazzle from Gunflash and Searchlights

The crew of aircraft caught in searchlight beams may be subjected to considerable dazzle, not so intense as to be painful (at practical heights, illuminations at the eye are comparatively low) but sufficient to interfere seriously with fully dark-adapted vision. The chief sufferer is the air-gunner in a bomber who is on the lookout for enemy fighters. The dazzle results from three causes: (i) physiological dazzle produced in the eye; (ii) physical veiling-brightness by light scattered in the windows of the aircraft; (iii) physical veiling-brightness by atmospheric scatter in the searchlight beam.

Investigation showed that all three causes produced effects on vision of the same order of magnitude, and frequently corresponded to veiling-brightnesses which greatly exceeded the brightness of the night sky. While the dazzle from windows could be reduced by the use of glass in place of perspex, and could be eliminated by the use of clear vision-panels, i.e., open panels, little could be done to restrict physiological dazzle, and nothing at all to reduce the beam-scatter.

Gunflash dazzle was mainly a problem for the physical chemists and workers on armaments-research, whose aim was to produce flashless propellants, flash-eliminators, etc. But other investigations, both field and laboratory, were made to help in developing methods of assessing the amount of dazzle produced and to increase knowledge of the extent and manner in which flash-dazzle interferes with the vision at night. We now have a general picture of the dazzle effect. With a small source of dazzle, continuously exposed, the effect on the vision of a neighbouring object increases rapidly as the angular separation between object and glare-source is reduced, and it happens that a very simple quantitative law obtains: at  $\theta^\circ$  from the dazzle-source, vision is impaired just as if a veil of light were thrown over the object, the intensity of the veil being proportional to the illumination at the eye from the dazzle-source and inversely proportional to the square of the angle  $\theta^\circ$ . Moreover, if the dazzle-source is exposed as a flash, the recovery of each part of the retina follows the same time-course as if this so-called "equivalent" veiling-brightness (as given by the formula just mentioned) had been flashed on for the

same time. This was a great simplification, as it enabled the effects of point-sources of dazzle in any position to be reduced to the case of a uniform flash over the whole field.

Complete sets of results were obtained showing how the visual threshold in the dark recovered from field-flashes, for intensities covering the whole of the practical range. With these data, it was necessary only to determine the physical characteristics of a gunflash—its angular extent, brightness, and duration—to predict the effect on vision under a wide range of conditions. The relevant physical characteristics could be determined by a photographic method, admittedly rather laborious. Two special points may be mentioned. Although the gunflash has a very high brightness, in some cases equivalent to a hundred or more equivalent foot-candles acting for 1 second (an intensity which is well in the region of daylight or cone-vision), the effect on subsequent recovery in the dark depends on the scotopic value of the light. This means that the measuring instruments for assessing the brightness of flashes had to have a spectral response-curve appropriate to the scotopic or dark-adapted eye. Colours of gunflashes are just sufficiently various to make this point worth taking into account. While the dazzle-effect on each part of the retina could be calculated, the extent to which a dazzled observer could sight on an object by using indirect vision and "looking round" the worst affected area was still uncertain. By actual sighting-tests in a laboratory simulation, it appeared that under typical conditions an observer could sight round the dazzled patch covering the foveal retina provided this did not entail indirect vision to more than about  $3^\circ$  from the normal direction of fixation. Thus, for a given brightness of dazzle-flash, the flash covering the fovea would have its full dazzle-effect on sighting only if its angular radius exceeded about  $3^\circ$ . For smaller flashes the disabling effect was progressively reduced.

For some weapons, particularly quick-firing weapons in aircraft, a direct measurement of the effect of gunflash was desirable. A simple instrument based on the principle of the reflector-sight was designed for this purpose by Dr. Goldie of the RAF Physiological Laboratory. The "target" object was reflected into the field of view by an inclined glass-plate through which a practically unimpaired view of the dazzle-flash and background was obtained by transmission. The time to recover vision of the object after dazzle was measured. While the results obtained show considerable individual variation, and may be affected by the sky-brightness, the fact that the instrument can be installed in the gunner's position, and can be used under conditions closely approaching the practical case, made it a very useful practical tool.

## 3. Dazzle as a Possible Weapon

The idea that dazzle could be used as a weapon was constantly recurring during the war. On a very bright moonlit night a pilot well caught in the beam of a searchlight is prevented by dazzle from seeing objects on the ground within some 2 miles [3.2 km.] of the searchlight. By constantly holding an enemy aircraft in several beams spaced at the corners of a square pattern of 4 miles [6.4 km.] side, we might expect to obscure the ground completely. To deal with a number of aircraft without having to sight searchlights on each, it was proposed in several schemes to install powerful non-directional lights spaced in a pattern

over the whole countryside. Schemes of this kind fail for two main reasons: (i) because of the enormous amount of electric power demanded, (ii) because in the presence of cloud the light reflected back on the ground is insufficiently intense to make objects more visible than if the lights were extinguished. More-modest schemes were a little more hopeful. Experiments were made to see if comparatively weak, steady but directional lights of the type of motor-car headlights could be used at spacings of the order of 100 feet [30.5 m.] to provide a kind of dazzle-screen against ground attackers. It was found that such a screen, while of some value in concealing ground objects such as men, vehicles, low buildings, etc., produced a useful effect in only a limited period of about  $\frac{1}{2}$  hour during nightfall.

In another group of schemes, the aim was to destroy the dark-adaptation of enemy pilots attacking ships or bombers under conditions of low illumination. The method was to fire a powerful light-flash at some critical moment during an attack. Without going into details of the several schemes of this kind which were tried out, it may be said that they suffered from the following handicaps. With the highest practicable flash-intensities—from the ship or bomber, or projected to the neighbourhood of the attacking aircraft—useful dazzle could be obtained, if at all, only at very low levels of natural light, moonlight or less. Under these conditions, it is difficult or impossible to sight on the attacker for the correct timing and, possibly, directioning of the dazzle-flash. The dazzle-flash can at best give a momentary respite of a few seconds and, on the whole, the value was small.

A dazzle scheme or, more strictly, a confusion-light scheme of a different kind, led to an interesting laboratory experiment. The Germans used a radio-controlled bomb in daylight attacks on ships, which could be turned to or right, forwards or to the rear, during its descent. In this way aiming errors could be corrected. After bomb-release, the bomb-aimer was able to see the bomb and so

correct its trajectory by the aid of a powerful flare fixed to its tail. The possibility was considered that similar flares might be shot up from the target ship which would confuse the bomb-aimer and upset the visual judgements on which his control depended. An optical simulation of the field of view of the bomb-aimer's sight was set up showing the target ship, the moving bomb-flare following its correct undisturbed projectory, and, when desired, a cluster of flares moving as they would do if shot up from the target ship. By a system of motor-driven mirrors in the apparatus the motion of the bomb-flare could be modified by the observer just as in practice by left-right, forward-aft controls.

The experiments consisted in comparing the accuracy of controlled bombing in the model (a) with no flares, (b) with confusion-flares in operation. Observers had to be trained in the control before a fair comparison could be made. Determinations were made of the distribution of bombing errors, (a) without control, (b) with control, (c) with control and confusion-flares. The results were fairly conclusive that the confusion-flares produced only a slight disturbance. This laboratory study enabled difficult and elaborate full-scale trials to be dispensed with, and at the same time indicated certain possibilities in the ground-training of personnel operating radio-controlled bombs.

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On the whole, it may be said that dazzle as an actual weapon of war has proved disappointing, while in those cases where it interferes in some measure with efficiency it is not particularly easy to eliminate.

#### ACKNOWLEDGEMENT

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## HEARING-PROBLEMS INVOLVED IN SYSTEMS OF INTERCOMMUNICATION

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The space at my disposal does not permit me to touch on all aspects of research work undertaken by the department of otorhinolaryngology of the RAF. I shall confine my remarks to some problems of noise which we had to study, the effect it has on personnel, equipment used, and the means we adopted to overcome these problems. It may perhaps be wondered how a department of otorhinolaryngology has become involved in the subject of intercommunication, so perhaps a few words on this subject may be helpful. The department is concerned not only with the clinical aspects of the speciality, but with all aviation problems involving hearing. An acoustics laboratory, staffed by technical experts, is an integral part of the department, and studies applied acoustics in the field of aviation-otology.

In modern combat-aircraft it is absolutely essential to have good speech-communication between the aircraft and the ground controlling-stations, between the crews of different aircraft, and between the individual members of the crews. This communication must take place over electrical channels involving microphones, telephones and amplifiers, and the success of an operation frequently depends on the accuracy with which information is passed through these channels.

There is present at all times in an aircraft the very loud noise from the engines and propellers of the machine. The intensity of this noise depends upon the aircraft, and usually lies somewhere between 105 and 120 decibels above threshold. It is therefore capable of causing permanent damage to hearing if adequate protection is not provided. Obviously, precautions must be taken to shield both the speakers and listeners from this noise as much as possible, and care must also be taken to ensure that the personnel selected for aircrew-duties should be capable of understanding speech transmitted through telephones in the presence of a background-noise of this type. It has been known for some time that individuals differ in their ability to understand speech in noisy surroundings, and that this ability is not related directly to acuity of hearing as measured by the ordinary threshold tests.

There are two lines of attack on the problem of improving the standards of speech-communication in the air. (i) The devising of selection-tests, to be administered at the selection-boards for aviation candidates, which would weed

out those candidates who cannot understand speech in noisy surroundings. (ii) The provision of protecting devices, such as helmets fitted with sound-excluding telephone-holders, which are to be worn by all members of an aircrew in order to reduce the intensity of the noise actually reaching the ear and hence to reduce its masking effect upon speech. In this way it is possible to protect the hearing from damage caused by exposure to the loud engine-noise. It is necessary, in most aircraft, for the crew at some time to be supplied with oxygen. The mask which is used in conjunction with the oxygen-equipment, and which covers the nose and mouth, serves also to hold the microphone and to reduce the intensity of the noise entering the communication-channel via the microphone.

I will now describe in some detail advances made along these two lines during the war.

### Hearing-Tests

Until very recently, the only test of hearing which every candidate for flying duties with the RAF had to pass was the 20 feet [6 m.] forced-whisper test. In this test the candidate had to be able to repeat, using each ear separately, a list of words whispered to him at a distance of 20 feet. An orderly stopped with his finger the ear which was not being tested. When carried out under the best conditions, this test gave an indication of the candidate's ability to understand very faint speech in quiet surroundings. In normal use, however, the results were apt to reflect differences in the background-noise present in the testing-rooms, in the accents of the testers, and in the lists of words which they are accustomed to use. At the best it did not measure the particular ability required of members of an aircrew, namely, the ability to understand loud speech in a background of loud noise. In other words it was not a standard test and it did not measure what was required.

In 1941 it was decided to set up an acoustics laboratory in the department of otorhinolaryngology at the RAF Central Medical Establishment with the task of devising a new hearing-test which would not have these disadvantages and which could be applied to the extremely large numbers of aviation-candidates who were passing through the medical boards at that time. The technical staff to work in this laboratory was transferred from the Radiotelephony Speech Unit of the RAF Fighter Command and consisted of a phonetician, a physicist, and an electrical engineer. The laboratory is fully equipped to reproduce under controlled conditions the noisy surroundings encountered in military aircraft and to perform noise-intensity measurements and analyses, speech-articulation tests, and a wide range of audio-frequency electrical measurements.

As a result of experimental investigation, in the course of which several thousands of RAF personnel were given speech-articulation tests in a background of engine-noise, a test was devised which, it is believed, weeds out those candidates who are likely to prove unsatisfactory as members of an aircrew. The development of this test was completed in the early months of 1943, and is now the official hearing-test for the flying branch of the RAF. The hearing-test is in two parts, which are known as the Hearing Efficiency Test and the Pure Tone Test. Both these tests are recorded on gramophone-discs, and can be given to a number of men, up to a maximum of 10, at the same time. A compact

form of testing equipment known as the RAF Gramophone Audiometer has been constructed for applying these tests. It is essentially a high-quality electric gramophone, which is calibrated every day in order to ensure that the intensity of the output-signals does not vary.

The Hearing Efficiency Test is a speech-sound articulation test carried out in the presence of engine-noise comparable in intensity and spectrum with that reaching the ears of the crew under normal flying conditions. The speech and the engine-noise are recorded on a gramophone-disc and are led together to both ears of the candidates under test.

The Pure Tone Test is a rough form of pure-tone audiometry and indicates whether a candidate's hearing is effectively normal in each ear at octave-intervals throughout the frequency-range 250-4,000 cycles per second. It consists of groups of pure tone "pips" at an intensity level of 20 decibels above normal threshold, for each of the frequencies 4,000, 2,000, 1,000, 500 and 250 cycles per second. The candidate is tested in each ear separately, and he has to count the number of pips in each group and write down his answers on the form provided. In order to pass the test the candidate must respond satisfactorily at all 5 frequencies in each ear. Women's Auxiliary Air Force (WAAF) personnel-selection clerks have been trained in the acoustics laboratory to apply these tests and to record the results on the candidates' medical documents. The servicing of the equipment is undertaken by the acoustics laboratory.

These tests have now been in use at the only Aviation Candidates Medical Board still functioning in the RAF for six months and have given satisfaction with the limited number of aviation-candidates being accepted into the Service.

### Aids to the Protection of Hearing

The other function of the laboratory has been to assess the efficiency of various devices such as flying-helmets, headbands, etc., in protecting the hearing of flying personnel from damage caused by the intense noise. The standard method of measuring the protection afforded by such a device, say a helmet, has been to expose a person to a loudspeaker source of pure tones and to determine his threshold when exposed directly to the sound and also when protected from the sound by the wearing of the helmet. The difference in decibels between these two thresholds at each frequency gives a measure of the amount by which the helmet attenuates sound of that particular frequency. This method is rather tedious, in that the measurements, even with a single person, have to be repeated a number of times in order to get a stable mean-value of attenuation.

Because of differences in the way in which the helmet fits different persons the mean value thus obtained varies from person to person and it is necessary to test a fairly large number of persons and to express the results as a mean of the individual findings. This makes the comparison of different types of protective devices a very laborious and time-consuming business. In order to overcome this difficulty, a method of testing has been developed in the acoustics laboratory which enables a quick comparison to be made between different helmets. In this method, a microphone is mounted in a wooden head to serve

as a dummy ear, and the voltages which develop across the microphone when the head is exposed to a source of sound are measured, first, when the head is uncovered and, secondly, when it is covered with the helmet. The difference once again gives the attenuation of the helmet at any particular frequency. These measurements can be made very quickly, and if care is taken to ensure that the pressure of the helmet on the head is constant, they are quite repeatable. It is true, of course, that the seal between the telephone-holder and the side of the wooden head differs from the seal achieved with the human head, with all its unevenness, and for this reason the subjective type of measurement may give a better representation of the average amount of protection which the helmet will give to the wearer. However, the objective method is an invaluable aid in the development of helmet-design.

At the beginning of the war the type B leather helmet was the only one available for flying personnel, but this has now been replaced by the type C helmet which is much more comfortable to wear and is available in leather for home use; or in cotton-drill for use in the tropics, or in aertex for use on long patrols, e.g., in Coastal Command, where comfort and lightness are of great importance. It was developed in the department of otorhinolaryngology, based on such data as head-measurements, noise-exclusion properties, comfort, etc. Experience over several years has shown that this type C helmet gives adequate protection to the hearing, and that, if the helmet is properly worn, exposure to aircraft-engine noise for the longest periods will not cause deafness.

Special classes of non-flying personnel, such as engine-test-bed operators, may be exposed to noise which is much more intense than that encountered in normal flight, and additional protection has to be provided to safeguard their hearing. This can take the form of earplugs or specially-designed headbands giving a high value of sound-exclusion. The laboratory has been able to give a considerable amount of help in assessing the performance of these earplugs and headbands.

It would seem that in the future the gas-turbine will have an increasingly important part to play in the development of combat-aircraft. The noise produced by this type of engine differs both in intensity and frequency-content from that produced by the ordinary reciprocating engine, and it is known that when the engines are accelerated with the aircraft on the ground the intensity of the noise in certain spots outside the aircraft may rise well above 130 decibels. It appears, however, that in the air the noise is much less intense and is unlikely to call for any change in the flying-helmet. An investigation into the character of the noise under different conditions is being carried out at present in conjunction with the Central Fighter Establishment.

The most direct approach to the problem of reducing the effects of noise on communication lies in the soundproofing of the aircraft, but unfortunately it is very difficult either to silence the engine without reducing its performance—or to soundproof the body of the aircraft—without adding considerably to its weight—and so this method has not had much application to military aircraft. It will, of course, be of great importance in the development of civil aviation, where the comfort of the passengers is of paramount importance.

## NOISE AND HEARING IN RELATION TO THE PROBLEMS OF THE ROYAL NAVY

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In the Royal Navy, blast and gunfire are the chief causes of loss of hearing. While the gradual progressive deafness of cochlear type, commonly known as gunner's mate's deafness, and the injuries to the tympanic membrane with transient middle-ear deafness, are well known, the severe hearing-loss of cochlear type following a single instance of blast due to gunfire or other agent is not so well recognized.

FIG. 1. POSITION OF GUN-CREWS

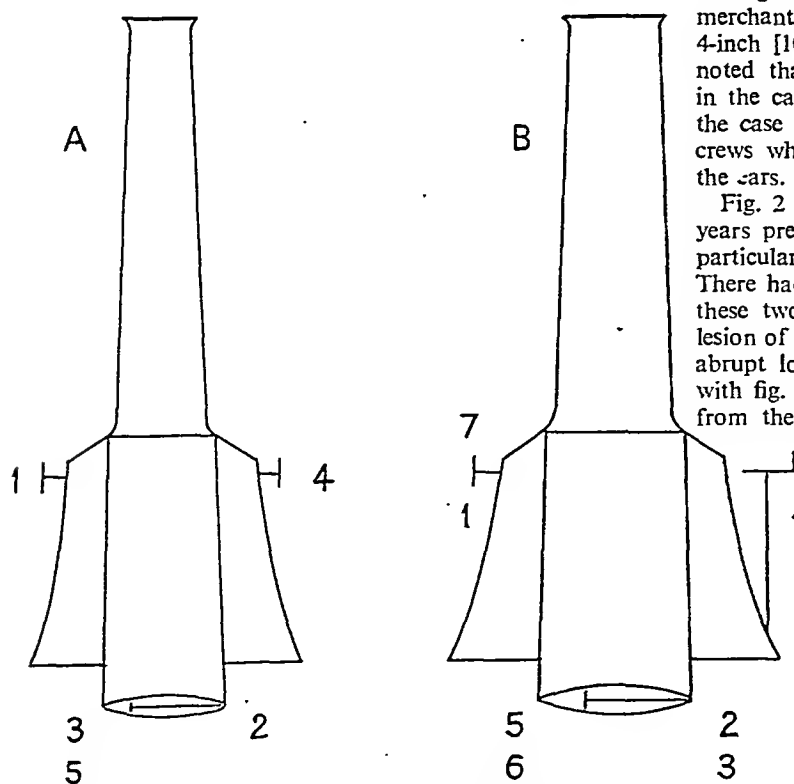
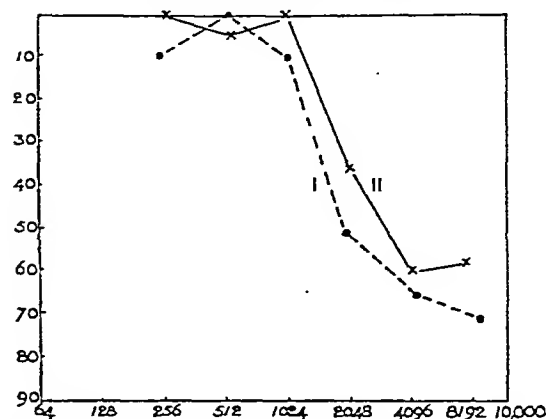


Diagram of (A) 12-pounder [5.4 kg.] and of (B) 4-inch [100 mm.] guns, the numbers showing position of the gun-crews (1-7)

In a series of 69 traumatized ears investigated by audiometry at a naval hospital (Suggit, 1943), 26 showed this type of loss. In another series of 139 audiograms of naval ratings rejected for submarine-detector duties by Surgeon Lieutenant-Commander Ransome-Wallis at H.M.S. *Osprey*, 62 showed this type of severe cochlear damage.

FIG. 2. BLAST-LESION OF THE COCHLEA IN A NAVAL-RATING



Ordinates : hearing-loss in decibels  
Abscissae : frequency in double vibrations per second  
I = right air-conduction  
II = left air-conduction

The majority of cases in the first series were naval-ratings undergoing training at a range for service as gunners in merchant ships. The guns used were a 12-pounder<sup>1</sup> and a 4-inch [100 mm.]. These are shown in fig 1. It is to be noted that no gunshields were fitted. Numbers 1 and 4 in the case of the 12-pounder and numbers 7, 4 and 1 in the case of the 4-inch gun were the members of the gun-crews who most frequently suffered from blast-injuries to the ears.

Fig. 2 shows the hearing-loss in a naval-rating who two years previously had been deafened by a round from this particular 4-inch gun while acting as No. 7 of the crew. There had been no subjective change in the hearing during these two years. It shows the characteristics of a blast-lesion of the cochlea with normal low and middle tones and abrupt loss of hearing in the high tones. This contrasts with fig. 3, which shows a gradual decline in hearing from the low tones where it is least, to the high tones where it is greatest. This is the progressive form of cochlear lesion or occupational deafness, and is due to repeated traumata of high-intensity sound or blast-waves, and not to a single blast-concussion. In this case (a naval-rating aged 36, who had been a gunner for two years only) a marked progressive deafness had supervened in a relatively short space of time. The period of development is usually much longer, and it has been said that we saw in senior officers and men in this war the effects of high-explosives in the first world war.

<sup>1</sup> [A gun firing a projectile weighing 12 pounds or 5.4 kg.—Ed.]

The protection used by the naval-ratings under training on this range was cottonwool wads. Eventually gunshields were fitted to these guns. From this date, the incidence of blast-deafness on this range fell rapidly. Instead of seeing some six cases of blast-deafness every week-end following the previous week's exercises, I saw hardly a case.

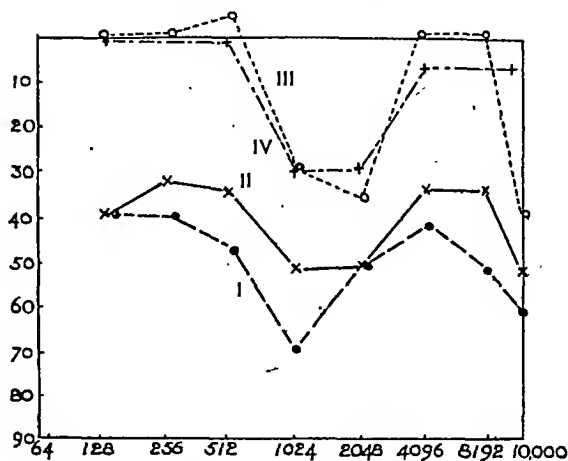
Fig. 4 shows a much more uncommon type of blast-deafness. It is essentially of middle-ear type, with the addition of a cochlear lesion in the middle tones as shown by the severe dip in the audiogram of bone-conduction in this zone. This lesion occurred 4½ years previously in an officer aged 31, who was near a motor-torpedo-boat when it exploded. Some improvement in hearing occurred in the first 2 months after injury, but since then the hearing had remained stationary.

An interesting experiment was carried out at H.M.S. *Excellent*, in which comparative tests with a dummy head incorporating a piezo-electric blast-pressure-gauge were made of the blast-protection afforded to the ear by a standard naval blast-helmet, an earplug, and service headphones. When the ear-passage faced towards the charge, the earplug reduced the pressure experienced at the position of the tympanic membrane from 4.5 pounds/inch<sup>2</sup> [0.3 kg./cm.<sup>2</sup>] to less than 0.1 pound/inch<sup>2</sup> [0.007 kg./cm.<sup>2</sup>], the headphones reduced it to about 0.7 pound/inch<sup>2</sup> [0.05 kg./cm.<sup>2</sup>] and the naval blast-helmet to about 3.3 pound/inch<sup>2</sup> [0.2 kg./cm.<sup>2</sup>]. Similar reductions in blast-pressure were obtained from the earplug and the headphones when the ear-passage was perpendicular to the direction of travel of the blast, but no appreciable reduction in the peak-pressure was obtained with the blast-helmet. An observation was also made with a wad of cottonwool in the ear-passage, the reduction in blast-pressure in this case being about 79 %.

These results are the reverse to those obtained in attenuation of the sound-waves produced by aircraft, as it has been found that the RAF flying-helmet attenuates sound to a greater extent than any earplug (Dickson & Ewing, 1941).

Loss of efficiency due to blast-deafness is always a serious matter, but is particularly so when naval-ratings trained in

FIG. 4. BLAST-DEAFNESS OF MIDDLE-EAR TYPE



Ordinates : hearing-loss in decibels

Abscissae : frequency in double vibrations per second

I = right air-conduction

III = right bone-conduction

II = left air-conduction

IV = left bone-conduction

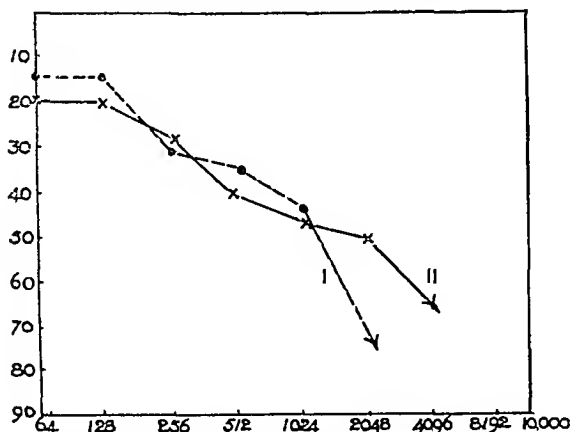
the operation of submarine-detector gear are concerned. These ratings are selected for their normal hearing and trained in the perception of sound of varying pitch and intensity. Ratings accepted as submarine-detector operators must have less than 20 decibels of hearing-loss for the frequencies 512 to 2896, and 30 decibels at 4096 cycles. They must also be able to distinguish a difference of + or - 30 cycles' change against a fundamental of 1,000 cycles.

Surgeon Lieutenant-Commander Ransome-Wallis carried out an interesting series of investigations on fatigue among submarine-detector ratings. The auditory threshold to sound-intensity was found to reach its peak in 15 to 30 minutes after listening commenced, and to show fatigue after 45 to 60 minutes. Recovery occurred after a further 15 minutes, but at the end of 2 hours a decrease in aural threshold was evident. Subjects with no previous experience were shown to reach peak-efficiency and to become fatigued at much the same rate as those with long operating-experience. A marked fatigue-factor in pitch-discrimination was also found. This was particularly evident in the second hour of the listening period. Fatigue in pitch-discrimination varied considerably among different individuals. As a result of these investigations the submarine-detector personnel were limited to watches of one hour.

One interesting point made by Surgeon Lieutenant-Commander Ransome-Wallis is that pitch-discrimination is normally better for notes of a lower frequency than for notes of a higher frequency than the reference note.

Gun-crews working in turrets are reasonably protected from blast-concussion, and for that reason the present-day policy of mounting the secondary armament, and also the guns of small ships, in turrets, has done much to reduce blast-trauma to the ears. Blast-deafness often occurred in men caught unawares on deck and other exposed positions. Submarine-detector personnel are therefore kept away from parts of the ship in which they are liable to receive blast-effects. Rubber earplugs, improved MSA (Mines Safety

FIG. 3. PROGRESSIVE FORM OF COCHLEAR LESION



Ordinates : hearing-loss in decibels

Abscissae : frequency in double vibrations per second

I = right air-conduction

II = left air-conduction

Continued at foot of page 57

# Notes on Contributors

DR. J. C. WATERLOW was employed during the war by the Medical Research Council in investigations on methods of increasing the efficiency of military personnel in hot climates. In 1943, with Dr. W. S. S. Ladell, he was sent to Iraq to study the problem of heat-stroke and heat-exhaustion. He is at present an assistant in the Medical Research Council's Human Nutrition Research Unit, and has been working on malnutrition of infants in the West Indies. His interest is in the common ground between physiology and clinical medicine.

DR. W. S. S. LADELL is attached to the Yaba Medical School at Lagos, where he is carrying on research into tropical physiological problems. He has previously contributed to the Bulletin a paper on "Thermal sweating" (*BMB* 735), and a note on his work has already been published.

SURGEON-LIEUTENANT COMMANDER F. P. ELLIS is the Secretary of a Sub-Committee of the Royal Naval Personnel Research Committee of the Medical Research Council which has been carrying out investigations since 1944 to determine the upper limiting levels of thermal conditions under which men can carry out the varying degrees of physical and mental activity normally necessary in warships without loss of efficiency or impairment of health. His past publications include papers on blood-transfusion, methods of oxygen-administration, and nitrous-fume poisoning, as problems of naval medicine.

DR. J. S. WEINER was a member of the Wartime Medical Research Council Team on Climatic Physiology at the National Hospital, Queen Square. He was previously engaged on the physiological study of high temperatures in South Africa and later at the London School of Hygiene and Tropical Medicine. He is at present Reader in physical anthropology in the University of Oxford, where he is continuing the study of adaptation of man to climatic extremes. His published work on high-temperature physiology includes investigation of the blood-circulation, sweating, kidney-function and efficiency.

DR. G. M. MORANT was formerly on the staff of University College, London, where he carried out researches in anthropology and statistics. He is now engaged at the RAF Institute of Aviation Medicine in applying the methods of those subjects to flying-problems.

DR. H. D. DARCUS is a graduate of the University of Oxford. He is at present a working member of

the Operational Efficiency Sub-Committee of the Royal Naval Personnel Research Committee of the Medical Research Council. He is responsible for the investigation of the anatomical and physiological problems which arise in connexion with naval war-weapons. He is a member of the Anatomical Society of Great Britain and Ireland and is the author of "Some anatomical problems in naval warfare" (in press) as well as numerous confidential reports to the Medical Research Council.

DR. A. G. M. WEDDELL has previously contributed to the Bulletin a paper on "The anatomy of cutaneous sensibility" (*BMB* 733), and a note on his work has already been published.

MR. ALEC RODGER has been senior psychologist to the Admiralty since 1941. He is on loan from the National Institute of Industrial Psychology, to whose vocational-guidance staff he has belonged since 1929. He is a member of the Occupational Psychology Committee of the Medical Research Council, editor of *Occupational Psychology*, and honorary treasurer of the British Psychological Society.

WING-COMMANDER DENIS WILLIAMS has previously contributed to the Bulletin a paper on "The clinical application of electroencephalography" (*BMB* 613), and a note on his work has already been published.

DR. D. RUSSELL DAVIS is one of a group of workers in the Psychological Laboratory of the University of Cambridge who, with the support of the Medical Research Council, are extending the methods of experimental psychology to a variety of occupational problems. He qualified in medicine in 1938 and, after a short period in practice, returned to Cambridge University, of which he is a graduate, as a research student in experimental psychology. During the war he studied the causes of the errors made by pilots, and his most important researches have been made into the disorders of skill. Not only are these disorders pertinent to the causation of accidents, but by their study light may be thrown on the broader forms of failure of adaptation, which constitute neurosis. Several papers on these topics are now in course of publication.

DR. H. E. HOLLING is a member of the scientific staff of the Medical Research Council, and works at the Council's unit at Guy's Hospital. He trained at Sheffield University and is primarily interested in the vascular system. Holding a commission in the RNVR, he took a practical interest in naval problems during the 1939-1945 war. He was

concerned in the prevention of immersion-foot, sea-sickness, body-wounds, toxic-gas poisoning, and heat-exhaustion. He collaborated in the writing of an Admiralty publication on the heating and ventilation of naval vessels. His published work includes papers on foetal plasma-proteins, the oxygen-usage of human muscle, vasodilator nerves in the human subject, urinary infections, cervical rib, varicose veins, shock, and methyl-homide poisoning.

DR. W. S. STILES is a member of the scientific staff of the National Physical Laboratory. He has been concerned for some years with problems of physiological optics and with the performance of the eye under various lighting-conditions. His published work includes papers on the nature and effects of glare on the directional sensitivity of the retina, and the spectral sensitivities of the rod- and cone-mechanisms of vision. During the war he worked on methods of visual scanning, and other problems involving vision.

AIR COMMODORE E. D. DALZIEL DICKSON has been consultant in otorhinolaryngology to the RAF since 1938. He is in charge of an acoustics laboratory dealing with hearing-tests, effects of noise on auditory acuity and means of protection, etc., and is engaged in research problems in the field of aviation otology. He served with the RAMC from 1918-22 as ear, nose and throat specialist, joined the RAF in 1923, and has been engaged in surgical and ear, nose and throat duties at home and abroad. He served in the Balkans, Palestine, Middle East and Iraq. He is a Fellow of the Royal Society of Medicine, a member of its sections of laryngology and otology, and joint author of numerous papers in the *Journal of Laryngology & Otology* on various problems of aviation otology. A monograph incorporating most of these papers is in preparation and is to be published shortly.

MR. STEPHEN SUGGITT is surgeon in the ear, nose and throat department of University College Hospital, civil consultant to the Admiralty, laryngologist to London Chest Hospital and to Harefield & Clare Hall Sanatoria, and Surgeon Lieutenant-Commander, RNVR. He is a Fellow of the Royal Society of Medicine, being a member of its sections of laryngology and otology; and is a member of the Association for Study of Diseases of the Chest and of the British Association of Otolaryngologists. His publications include papers on the variation in hearing in otosclerosis, and on deafness resulting from gunfire and explosions.

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## NOISE AND HEARING IN RELATION TO THE PROBLEMS OF THE ROYAL NAVY

*Continued from page 56*

Appliance) pattern, are now a general issue to all upper-deck personnel, and are a great advance on the wads of cotton-wool previously used.

Occupational deafness of cochlear type is also seen as a result of exposure to the noise of internal-combustion engines, that

is, aircraft and motor-torpedo-boats and motor-gun-boats. In the case of air-crews, protection as in the RAF is afforded by headphones and flying-helmet. Engine-room ratings of small ships are issued with rubber earplugs.

### REFERENCES

- Dickson, E. D. D. & Ewing, A. W. G. (1941) *J. Laryng.* 56, 225  
Suggitt, S. C. (1943) *J. Laryng.* 58, 313



HERETO the Bulletin has contained, in addition to the scientific symposium which occupied the greater part of each number, subsidiary sections of bibliographical and historical interest. Starting with the present number, the Bulletin will be clearly divided into two parts. The collective monograph on a special subject which has become the characteristic feature of the Bulletin will constitute Part I. Part II contains miscellaneous articles on medical subjects of scientific, bibliographical, and historical interest. The book-review section will be extended and there will, as before, be sections devoted to historical notes, film-reviews, and lists of contents of current British medical and cognate periodicals. It is our intention that Part II should be a medium for extending the range of interest of each number of the Bulletin and for enhancing its continuity as a periodical.

[illegible]

## Annotations & News

Social medicine at Oxford—Some literary by-products of the chemical industry—Health of London—Important new abstracting service—Medicine at the cross-roads—"Que sais-je"—Swiss Academy of Medical Sciences—New anaesthesia journal—General microbiology—Recent Progress in Medicina—South american medical periodicals—Journals received.

e anafilaxia—Descriptive atlas of radiographs—Handbook of radiography—Field service handbook of practical radiography—Manual of tomography—Neurosis and the mental health service—Tuberculosis in the West Indies—Re-adjustment in civil life of soldiers discharged from the army on account of neurosis—National health insurance in Great Britain 1911-1946—Health and social welfare 1947—Handbook for assistant medical officers of health on child welfare and school health work—La apendicitis en la primera infancia—Minor surgery—Surgery of the hand—Injuries and diseases of the oesophagus—Textbook of medicine.

## Historical Notes

THE CAMBRIDGE MEDICAL SCHOOL ...	<i>L. T. Morton</i>
JONATHAN HUTCHINSON: the only generalized specialist ( <i>Portrait</i> ) ... ..	<i>C. C. Barnard</i>
ANTONIO SCARPA 1752-1832 ( <i>Portrait</i> ) ...	<i>T. H. Bishop</i>
CENTENARY OF THE DEATH OF G. M. BURROWS 1771-1846 ... ..	<i>F. A. Tubbs</i>
JOHN ATKINS: an eighteenth century naval surgeon ... ..	<i>F. A. Tubbs</i>
JOHN AND WILLIAM HUNTER ... ..	<i>W. R. L.</i>

## Shorter Notices

Principles of anatomy and physiology for physical training instructors  
in the Royal Air Force—Demonstrations of physical signs in clinical  
surgery—Pye's surgical handicraft—El colapso circulatorio—  
Psychological medicine—Textbook of medical treatment—Edin-  
burgh post-graduate lectures in medicine—Vers l'infiniment petit  
—Clinical practice in infectious diseases—Pulmonary tuberculosis  
—Aids to dermatology—Practical anaesthetics—You and your  
children—The M.B., B.S. finals—Pasteur—Aids to the diagnosis  
and treatment of venereal diseases—Ocular prosthesis—Aids to  
public health—Esquisse d'une histoire de la biologie—Histoire de la  
science—Aids to bacteriology—Diseases of infancy and childhood—  
Penicilina—El enclavamiento intramedular de Küntscher.

## Book Reviews

Physics for the anaesthetist—Short handbook of practical anaesthetics—Spuren von Stoffen entscheiden über unser Schicksal—Biology of cell tissues—Genetics for medical students—Problems of family life—The nervous child—Some minor ailments of childhood—Care of young babies—Preservation of proteins by freeze-drying—Medical aspects of growing old—Middle East science—Cultivation of viruses and rickettsiae in the chick embryo—Virus as organism—Textbook of bacteriology—Now for health—Men under stress—Introduction to clinical neurology—Lehrbuch der Augenheilkunde—Pathology of traumatic injury—Penicillin: its properties, uses and preparations—La pénicilline à la portée du praticien—Estado actual de la farmacología arsenical—Histamina

## Books Received

## Films

It's up to you .  
Your children and you  
Scabies—1946

Penicillin in medical  
practice  
Medical films from Australia

## Guide to the Journals

*There is a growing interest in the history of medical science, as of other sciences. Although Daremberg was one of the greatest of medical historians, his work has received relatively little attention in the english-speaking world, and it was for this reason that Dr. A. HAHN, Chief Librarian of the Faculty of Medicine, Paris, was invited to contribute the article below. Dr. HAHN refers to Daremberg's study of Galen by comparison of greek text and personal dissection. This indicates what the history of science might be—but seldom is!*

## CHARLES-VICTOR DAREMBERG 1817-1872

### A Great Medical Historian

Dr. ANDRÉ HAHN

"La chaire d'Histoire de la Médecine," wrote Jules Guérin in 1830 in his report on questions relating to the organization of the Faculty of Medicine of Paris, "doit, éclairée par l'esprit philosophique de notre époque, jeter le plus grand éclat sur la science et raviver des germes ensevelis sous des débris ignorés. C'est moins l'histoire des livres que des choses qu'elle aura pour objet; et, s'il est vrai que le cercle des erreurs soit aussi borné que le cercle des vérités, ce sera déjà rendre un grand service à la médecine que de l'avertir et de la garantir par les révélations de l'histoire, du retour des erreurs passées."

These lines, written 8 years after the suspension in 1822 of the course in medical history and the consequent retirement of its head, Jacques-Louis Moreau (de la Sarthe), the librarian-professor, showed how essential the study of the history of the medical sciences, which was later to be so neglected, was considered at that time. It was, however, not until 40 years later, on 9 March 1870, that the Faculty finally achieved the inauguration of the new school; this was after a legacy of 150,000 francs had been left to the Faculty in 1869 by a former Master of the Requests to the Council of State, M. Salmon de Champotran, who was struck by the inadequacy of the historical side of medical education, and had in view the creation of a chair of the history of medicine and surgery.

In fact, the long eclipse of the teaching of medical history had been merely official, thanks to the extramural lectures given by Dezeimeris, librarian of the Faculty, and author of the *Dictionnaire historique de la médecine* (Paris, 1828-39) and *Lettres sur l'histoire de la médecine et sur la nécessité de l'enseignement de cette histoire* (Paris, 1838), and later by Charles-Victor Daremberg at the Collège de France from 1846 to 1864, and by Professor Eugène Bouchut at the École Pratique.



Wellcome Historical Medical Museum

Dr. Cuesco, the scholar and scientist, whom the endower of the new chair had nominated as its first occupant, declined the offer, and the Faculty was therefore free to choose between two candidates, both ex-librarians of the Académie de Médecine. The one, Guardia, had published a number of studies on the history of medicine, but his articles, which were stamped with a certain independence and bitterness of tone, had made him many enemies. The other, Charles-Victor Daremberg, associate member of the Académie de Médecine, and librarian of the Bibliothèque Mazarine for more than 20 years, had recently published his *Histoire des sciences médicales* (Paris, 1870).

As a result of a unanimous vote of the Council of the Faculty, Daremberg was appointed, on 2 May 1870, to the new Chair of the History of Medicine. It was a just tribute to the work of immense scholarship devoted to the ancient masters of medicine by the translator of Hippocrates and Galen.

#### Earlier Years

Born in Dijon on 17 April 1817, of an apparently humble family, the young Charles-Victor had, in the first place, to undertake intensive literary studies in his native town, under the direction of a priest, who later became Mgr. Morlot, Bishop of Orleans. He chose as his career medicine, in which he could combine his cultural studies with scientific practice. After acting as house physician in the Dijon hospital, he came to Paris in 1836 and for 8 years zealously walked the hospitals and attended lectures under Cloquet, Piorry, Andrè, Lisfranc, Michon, Velpeau, Bouillard,

Ricord and Cazenave, his chosen teachers. For 3 consecutive years he devoted himself, in the capacity of special assistant to Blainville and Gratiolet, to anatomical studies in the theatres of the Muséum d'Histoire Naturelle so as to verify, scalpel and greek text in hand, the work of dissection of the physician of Pergamos, and, like Cuvier, Camper and Blainville, he arrived at the conclusion that Galen had operated only on monkeys and other animals.

Professor Laboulbène has pointed out that Daremberg's first medico-literary work was a volume of 64 pages entitled *Bon jour, bon an*. This bears on the title page the words "Mon premier ouvrage," and then, "Premier livre que j'ai fait" as well as his signature. It is an almanac for the year 1839, with wood engravings, and was published at Auxonne by X. T. Saunié, printer and bookseller. In it are to be found astronomical tables and rules of health and practical medicine.

On the 20 August 1841, Daremberg submitted as his thesis for the degree of doctor of medicine, *Exposition des connaissances de Galien sur l'anatomie, la physiologie et la pathologie du système nerveux* (Paris, De Rignoux, 1841, 96 pp.). Dedicated to Drs. Guéniard and Descuret, who guided his early steps in medicine, it is a stirring tribute to Galen's system, and to its applications in diseases of the nervous system. The thesis was the fruit of reading entire treatises, and of research on the origins of Galen's knowledge in the work of his predecessors and on the fate of that knowledge in the works of his successors. Daremberg concludes in these terms:

"Combien ce puissant génie aurait dû hâter le perfectionnement de la science, s'il avait su mettre un frein à son imagination, s'il ne s'était pas laissé emporter comme un cheval indompté par son goût pour les systèmes et les explications, et surtout si ses successeurs n'avaient pas négligé le côté vraiment pratique de ses volumineux ouvrages pour s'égarer avec lui à la poursuite de théories surannées!"

From 1842 to 1849 Daremberg was medical officer to the Bureau de Bienfaisance and medical inspector of the primary schools of the Quartier St-Jacques in Paris, but during this time he continued to pursue his studies of greek, latin and french texts and manuscripts. In 1843 he published a translation of selected works of Hippocrates, *Œuvres choisies d'Hippocrate*, of which the second edition, published in Paris in 1855, includes commentaries and notes and is preceded by a general introduction.

#### Medico-historical Tours

It was at this point that this great traveller and scholarly interpreter of the ancient masters of medicine set out on the first of a series of tours abroad, which, sometimes on an official mission, sometimes at his own expense, he was to make, over a period of nearly 10 years, with the object of studying, analyzing, extracting or collating greek and french manuscripts dealing with the medical sciences, and of delving into scientific libraries. Four times he toured Italy and Germany and twice he went to Switzerland and Belgium. In the course of eight journeys to Britain, this indefatigable traveller visited London, Oxford, Cambridge, Edinburgh, and the Ashburnham and Sir Thomas Phillipps libraries.

After two years of preparatory studies, Daremberg was sent in December 1844, by the Minister of Education, Willemin, on a medico-literary mission to Germany for

three months. There he examined the papers of Professor Dietz, the eminent hellenist of Königsberg, who died in 1836, and he returned from this tour with important documents concerning Hippocrates, Rufus of Ephesus, Orbasius, Galen and the School of Salerno; in his report to the Minister (Paris, 15 April 1845) he gives a very interesting account of his mission. After this first journey he published the *Traité sur le pouls attribué à Rufus d'Ephèse, publié pour la première fois en grec et en français, avec une introduction et des notes* (Paris, 1846), as well as various articles, notably translations of two works by J. Rosenbaum on "The history and critical analysis of doctrines on diseases of the skin" and "The history of syphilis in ancient times, Part I", in Cazenave's *Annales des maladies de la peau et de la syphilis* (Paris, 1844-1852).

#### Librarian to the Académie de Médecine

When, in 1846, the post of librarian to the Académie de Médecine became vacant, Daremberg applied for it and was appointed. He held this post until 1849 when, as the result of a difference with the administration, he left the Rue de Poitiers to join the Bibliothèque Mazarine. His articles on medical scholarship, history and criticism in the *Gazette médicale* and in the *Union médicale* attracted public attention during the same year.

Meanwhile, the voice of the Congrès Médical made itself heard, and during the course of this same year, Daremberg was asked to give an additional course on the history and literature of the medical sciences, the first lecture being published in the *Union médicale* in 1847. A souvenir of this course, which was interrupted by the political events of 1848, is, however, left to us in the *Essai sur la détermination et les caractères des périodes de l'histoire de la médecine* (Paris, 1850), which consists of fragments of the course first published in 1848 in the *Gazette médicale*. These lectures were not to be resumed until 1864.

Meanwhile, Daremberg continued to publish his work. In 1847 there appeared a description of and extracts from manuscript no. 2237 in the Bibliothèque Royale, Paris: *Aurelius. De acutis passionibus*, the text of which was published for the first time from a manuscript in the Bibliothèque de Bourgogne in Brussels (Breslau & Paris, 1847). A year later we have *Fragments du commentaire de Galien sur le Timée de Platon*, published for the first time in greek and french (Paris, 1848). At the same time, accounts of his travels formed the subject of several articles, notably one on "A short account of a medico-literary tour in England", which appeared in the *Gazette médicale* (4 November 1848), and in which he announced plans for a library of greek and latin medical writers (prospectus published by V. Masson, Paris, 1847, 69 pp.). As bibliographer he edited a *Catalogue raisonné et analytique de tous les manuscrits grecs médicaux et des plus importants parmi les manuscrits latins et français de Paris et des Départements*. He included the greater part of his work either in official reports inserted in the *Journal général de l'instruction publique*, or in the *Notices et extraits des manuscrits médicaux . . . des principales bibliothèques d'Europe*. 1<sup>o</sup> Partie: *Manuscrits grecs d'Angleterre* (Paris, 1853), or else in various editions of greek or latin texts, or in the *Collectio salernitana* . . . published in Naples by Henschel, Daremberg and Renzi.

## Bibliothèque Mazarine

It was on his return from a tour of investigation in Italy with Renan in 1849, during which he visited the Vatican, Florence, Siena and the Abbey of Monte Cassino, that he had to leave the Académie de Médecine and join the Quai de Conti library. He remained there up to the time of his death in 1872, and it was from there that he published, in the course of 23 years, his principal works.

In collaboration with the dutch scientist Bussemaker of Amsterdam, on whom he commented in his report to the Minister on his return from his first tour in 1845, as being "trop occupé de Galien pour songer à Oribase", he started in 1851 to publish the greek text with a french translation of *Œuvres d'Oribase* (Paris, 1851-1876, 6 vol.), which was completed by A. Maumené.

It is not possible within the scope of this article to review all the works of so prolific an author. We can only mention the principal ones amongst those prepared either in the calm atmosphere of the Bibliothèque Mazarine or in the shade of the forest at St. Germain on the small country estate at Mesnil-le-Roi where from 1840 onwards Daremberg liked to spend the summer months; there, with his great friend Littré, he divided his time between his studies and a country clinic, where the two physician-philologists gave their services to the poor of the neighbourhood. It was also in this quiet retreat that this expert bibliophile formed the fine library on ancient medicine of more than 12,000 volumes, which the Académie de Médecine was to acquire in 1873 from his widow.

We shall mention, however, the *Glossulae quatuor magistrorum super chirurgiam Rogerii et Rolandi* (Naples, 1854); *Œuvres anatomiques, physiologiques et médicales de Galien*, translated for the first time into french, with notes (Paris, 1854-56, 2 vol.); *A. Cornelii Celsi de medicina libri octo. Ad fidem optimorum librorum denuo recensuit, adnotatione critica indicibusque instruxit* (Leipzig, 1859); *Gymnastique de Philostrate*, with french translation and notes (Paris, 1858); *La médecine, histoire et doctrines*, 2nd edition (Paris, 1865); *La médecine dans Homère ou études d'archéologie sur les médecins, l'anatomie, la physiologie, la chirurgie et la médecine dans les poèmes homériques* (Paris, 1865); *État de la médecine entre Homère et Hippocrate: anatomie, physiologie, pathologie, médecine militaire, histoire des écoles médicales* (Paris, 1869); *Recherches sur l'état de la médecine durant la période primitive de l'histoire des Indous* (Paris, 1867); *Œuvres de Rufus d'Éphèse* (Paris, 1879).

Daremberg did not confine his work to the history of medicine. He contributed to the *Journal des savants* and was also chosen as scientific correspondent to the *Journal des débats*, in which he published numerous articles on history and philosophy. He was also one of the editors of Franck's *Dictionnaire des sciences philosophiques* (1844-52, 6 vol.) (art. Galien) and of Dechambre's *Dictionnaire encyclopédique des sciences médicales* (Paris, 1869-73).

In 1864 the Minister of Education asked Daremberg for the second time to deliver a course of lectures on the

history of the medical sciences to the Collège de France. The 175 lectures that he read between 1864 and 1867 provided the material for his *Histoire des sciences médicales, comprenant l'anatomie, la physiologie, la médecine, la chirurgie et les doctrines de pathologie générale* (Paris, 1870, 2 vol.). In spite of its title and size, this is a fragmentary and rather unequal work, because of the requirements imposed by the publisher Baillière; none the less, it remains to this day one of the best-documented histories.

The Académie de Médecine, of which he had been honorary librarian since 1849, elected him, on 11 March 1868, as a *membre libre*. At the instance of his friends Littré and Sylvestre de Sacy, Daremberg had, in fact, already agreed to put forward his candidature for the seat left vacant by the death of Montagne in 1866. His brilliantly successful election by 50 votes to 20 for Th. Roussel and 6 for Amédée Latour was not merely a just recompense but also a tribute to a learned physician.

## / Professor of the History of Medicine

The war of 1870-71; the siege of Paris, during which Daremberg spent his days at the field-hospital organized by Paul Broca; the Commune which forced him, under threat of arresting both him and his son, to leave Paris suddenly on the 10 April 1871—all these things prevented him from beginning his course of lectures and from responding immediately to the summons of the Faculty. The cardiac disease to which he had been subject for some time further delayed the preparation of his course after his return to Paris on the 21 May. The first lecture could not take place until the 11 November 1871. Even then it was shortened on account of the state of fatigue of the Professor who was short of breath and obviously ill. The lecture dealt with the "démonstration historique de la supériorité des méthodes d'observation et expérimentale sur les méthodes *a priori*" (Paris, 1871), and demonstrated, in perhaps too-learned a form for an inexperienced audience, the importance of medical history.

Reduced in health as he was, this great historian was not perhaps able to make understood and appreciated all the advantages of a course, the original plan and method of which he had no time to modify. The *Dictionnaire des antiquités grecques et romaines*, the editing of which he had undertaken in collaboration with Saglio, still remained to be published, and during periods of remission from his illness, he did not lose hope of ensuring its publication. If he was not able to see this monument of scholarship, which was to run to 8 volumes (Paris, 1873), completely printed, at least he had the joy of reading the first sheets a few hours before his death.

Daremberg died on the 24 October, 1872 at the age of 55, in his peaceful home at Mesnil-le-Roi. This great historian of ancient medicine, who was as modest as he was hard-working, would not have desired obituary speeches. His monumental labour is the best possible memorial of the work of a universally respected scientist and scholar.

*Dr. RIDES' principal medical interests have been in paediatrics, especially in its preventive aspects. She has also had a special interest in Czechoslovakia and its health problems, and in April 1946 she was appointed to the staff of the British Council in Prague as Medical Adviser*

## MEDICINE IN CZECHOSLOVAKIA

### Impressions of an English Observer

Dr. ARNA E. RIDES

Although many are familiar with the names of Purkinje, Mendel, Skoda, Rokitsansky, Bednar, Chvostek, Jesensky and Edward Albert, few of us realize that these great men were Czechs or Slovaks.

Before the 1914-18 war, Czechoslovakia was a part of the Austro-Hungarian Empire and the great Czech and Slovak physicians often worked in Austria and Germany. They therefore, came to be regarded as Austrians. It was not until 1882, when the Medical Faculty of the ancient university of Prague (founded in 1348), was divided into Czech and German schools, that an independent school of Czech medicine was recognized, and only after the liberation of the Czechs and Slovaks in 1918 was this national school of medicine able to develop freely.

The rate of development was rapid. Medical schools were founded in Brno and Bratislava, and soon achieved reputations outside the borders of the State. Many fine buildings stand as a memorial to the excellent work done in this period. I would mention particularly the fine Purkinje Institute in Prague, which houses the university departments of histology, pharmacology, and general biology; and the splendid Masaryk Homes at Krc, near Prague, built by the city for the aged, the incurable, and for children suffering from chronic disease or congenital abnormalities. The names of men like Pelnr, Hlava, Mares and Kukula became known throughout Europe.

However, during the period between the two wars the influence of Germanic medical thought remained. The German medical school in Prague had a distinct advantage over the adjoining Czech school, in that it was able to exchange its teachers with those from the great Austrian and German centres. The Czech school, on the other hand, was poorer in equipment and without the same opportunities for external contact. During this time, French medicine ranked next to German in its influence over Czech medical thought. The French universities encouraged visits by Czechoslovak doctors and students, and many great Frenchmen paid visits to Czechoslovakia. The fine work of the French Institute in Prague was a major factor in fostering this close friendship. After 1920, the influence of American medicine gradually increased. Young doctors, who are now professors and

university teachers, went to study in America with the aid of Rockefeller Fellowships, and many of the finest health institutions in the Republic were built with the aid of Rockefeller funds, for example, the beautiful State Hospital in Kosice (fig. 1), the State Health Institute and the Masaryk School for Social Workers in Prague. American journals began to appear in the university departments and clinics, and English began to be studied to a greater degree. English medicine, too, began to exert an influence on Czech medical thought. A number of doctors came to study in Britain. Some of these, Professors Pelc and Simer, for example, lost their lives at the hands of the Germans. Others such as Professors Prusik, Sumbal, Syllaba and Wolf have based their teaching on the experience gained in Britain.

But even to-day, in spite of the consequences of the war, the predominating influence of German medical thought remains. It is most encouraging, however, to see how profoundly conscious the Czechoslovak medical profession is of this fact, and how diligently it seeks to widen the foundation of its science, and to base its medical thought on our common international scientific heritage.

### Medicine during the Occupation

Medicine in Czechoslovakia suffered severely as a result of the war and the occupation. The profession was isolated except from Germany, just at a time when medicine in the rest of the world was advancing with incredible rapidity. Many of the best men were imprisoned, sent to concentration-camps, or killed. 61 university teachers in Prague and Brno were killed or died as the result of ill-treatment, and a further 49 were arrested and imprisoned in concentration-camps but survived. The universities in Bohemia and Moravia were closed and the professors placed on retirement with a small pension. The university teaching hospitals were converted into ordinary hospitals and forbidden to pursue scientific work. The junior doctors were sent to work either in the country areas or to Germany. For six years no students were taught, and postgraduate teaching was difficult.

Fortunately, few hospitals were completely destroyed by war or air-raids, and new hospitals were even built or completed—the Praha-Motol, originally built as a military hospital, and Vysne Hagy, the beautiful sanatorium in the Tatra; the hospital (now the clinic of Professor Prusik) was greatly improved. Some hospitals were fortunate in acquiring new x-ray plants and sterilizing equipment, which the Germans installed but had not time to remove. On the other hand, a great deal of the more delicate equipment was stolen. The university theoretical departments were much less fortunate than the hospitals. They were converted to other uses, the buildings mutilated, the delicate laboratory apparatus broken, the microscopes stolen and the books lost. Although Slovakia remained an "independent" state, treated "favourably" by the Germans, and the University of Bratislava was allowed to remain open, numerous teachers were removed from their posts, and medicine was just as isolated as it was in the Protectorate. The hospitals in the eastern tip of the country came under the rule of the Hungarians, and much of their equipment was lost in consequence.

At the end of the war, the teachers who were left alive returned, much older, but with their spirit unbroken and determined to re-open the schools. They had to start from

the beginning to put their departments in order ; to find lost equipment, for there was no hope of obtaining new ; to repair buildings suffering from six years of neglect, or from air-raided damage ; and to reconvert those put to other uses by the Germans. They set to work with amazing speed. In Prague, lectures recommenced within three weeks of the liberation, although all the theoretical departments were left in complete disorder. The doctors and the staff joined the workmen in forming brigades to carry out the repairs. All the hospital teaching units have been open already for at least a year. It is stimulating to walk through hospitals to find medical work being carried on alongside that of builders and plasterers. Museum collections suffered perhaps more than anything else. Professor Neuman's famous and beautiful pathology museum in Brno was completely dismantled, the catalogues destroyed and many specimens broken. It will take years before it is in order again. But this is only one example. In Prague, nearly all the good collections have been lost or ruined.

### Present Difficulties

As a result of the occupation, a number of very serious difficulties are now facing the profession. First, there is a very considerable decrease in the number of doctors—from 10,000 before the war to less than 7,000 at the end of the war, many of whom were already past retiring-age. Moreover, during the war-years, doctors who would normally spend two years in a university clinic (i.e., hospital teaching-unit) and then become general practitioners, were forced to remain in the hospitals. As a result, there are now too many clinical specialists and too few general practitioners. Even more important, however, is the lack of trained men in the theoretical and scientific branches because, during the occupation, all scientific research work was strictly forbidden, although work was carried on to a small extent in secret. The lack of trained research workers is felt in all branches of medicine and is the most important feature of medicine in Czechoslovakia to-day, explaining why so little research work is being carried out in the Republic.

There is a great shortage of literature, and practically the only textbooks available are German, although Czech books are being published and reprinted as fast as possible. Students have to delay taking examinations until they can get a textbook to use. The thirst for literature from abroad is tremendous, but unfortunately the supply is still very limited.

The training of students presents great difficulties. Since the universities were closed during the war, doctors have to be trained to make up for six lost years. The numbers required were considerably overestimated immediately after the liberation, and all young people wishing to study medicine were admitted. Last year 5,620 medical students were enrolled at Prague University alone, as compared with 2,829 before the war (together with an additional 1,000 at the German University, now closed). There were 2,586 in the first year alone, and classes had to be given in the biggest hall in Prague with the aid of microphones. The teaching staff had to be increased from the 1937 total of 100 to 540. Fortunately many of these students had only a short period of study to complete their training, and over 1,000 qualified last year.

This situation caused intolerable strain to teachers and students alike. The medical teachers are profoundly conscious of the unsatisfactory position at present, and are doing

their utmost to overcome the difficulties. It is evident that some solution must be found to correlate the number of students both with the number of doctors required and with the teaching-facilities of the medical schools.

Medical teaching has always followed the Austrian pattern in taking place almost entirely in the lecture-room. Clinical training is allowed, but is not compulsory except for very short periods, and the relation between student and professor is much more distant than it is in Britain. However, one hears discussion on all sides about reform of the medical curriculum, and great interest is taken in teaching-methods abroad, particularly those in Britain.

In an attempt to deal with the great influx of students, and also to decentralize medicine by establishing important hospital centres outside the main towns, three new medical colleges were opened at Plzen, Hradec Kralove and Olomouc. These schools started without buildings, equipment, or books within 6 months of the liberation. The hospitals in the three towns were upgraded to university clinics, and a start was made in establishing theoretical departments. The work has already gone ahead rapidly. When I was in Plzen in the summer, a fine building was being converted into a theoretical school for use in the autumn, although it was known that very little equipment was likely to be available for years to come. At this time Plzen had no medical library. Olomouc is building new "utility" departments in the grounds of the hospital. A new and completely adequate "utility" anatomy department is already in use. Here, again, there is a great shortage of equipment, although a library has just been started with about 40 books. I was most interested to hear that the bedside method is being employed in teaching clinical medicine. A military academy has been converted into a medical school in Hradec Kralove, and here the school has been fortunate enough to inherit a fine international library left by the German army. Professor Smetanka, the Dean, is now the proud possessor of 12 microscopes for his students.

Such are the difficulties confronting the teachers of medicine in Czechoslovakia, and such is the spirit in which they are being overcome.

### Effect of the War on Public Health

The war has left marked effects on the health of the population. Food was short, especially fats and proteins, particularly in the later years. Milk was not available except for the Germans, distribution of all foods was unequal, and the development of a blackmarket a patriotic duty. Since the war, the food situation has improved with remarkable rapidity, thanks to UNRRA, an excellent harvest, and efficient distribution. Now the diet in Czechoslovakia is considerably more interesting than in Britain, although fats and dried milk are still not available in sufficient quantities to meet the needs of the children. However, the price of essential foodstuffs is higher than in Britain, and wages are lower, so that the poor mother with numerous children cannot afford to buy all the rations. The Government fully appreciates these difficulties and prices are falling steadily, although slowly. As may be expected, the poor nutrition during the war has left its marks on the children. In a survey of Prague schoolchildren conducted in 1945 and early 1946 at the request of the Czechoslovak Ministry of Health, Dr. Lewit, former assistant Medical Officer of Health of Wallasey, found 22% suffering from evidence of malnutrition according to British standards.



One of the most alarming facts about the health situation is the extremely high infant-mortality rate. In 1944, the last year for which complete figures are available, it was 99.7 per 1,000 live-births in Bohemia and Moravia, as compared with 45.4 for the same year in England and Wales. This figure rose to 110 in 1945. In Slovakia, no figures are available after 1942, in which year it was 159. It is most unlikely that it is lower now. The neonatal-death rate in 1944 in Bohemia and Moravia was 42 per 1,000 live-births, as compared with 24.4 in England and Wales. There is a large number of factors which contribute to these high figures—to cite a few: the low standard of nutrition of the mothers; the low standard of training, the bad distribution and the inadequate supervision of midwives, and the failure to eliminate untrained women; great overcrowding in the homes (one person per room is the upper legal limit for accommodation in Prague); great overcrowding and lack of nurses in the maternity homes; poor development of the infant-welfare service; ignorance of infant hygiene, particularly in the villages (the level of health and hygiene in Eastern Slovakia always has been particularly low); decrease in the number of mothers able to breast-feed; absence of health-visitors; the overclothing of infants which leads to pyodermal infections; the gross contamination of fresh milk and lack of dried milk; and, the lack of any real co-ordination between the various branches of welfare work.

Infectious diseases increased during the war, as they did in all European countries, the increase being particularly marked in the case of diphtheria and tuberculosis. It is interesting to note that in Slovakia, where diphtheria immunization was made compulsory during the war, the incidence has steadily decreased.

The incidence of tuberculosis has always been high in Czechoslovakia. In 1935, as many people died there of tuberculosis with a population of 15 millions as died in England and Wales, with a population of 40,600,000. Naturally, the war, with its accompanying malnutrition and overcrowding, caused a further increase, as also did the fact that tuberculosis was not recognized by the Germans as a disease requiring rest, and open cases were forced to continue work in the factories. The official death-rate per 100,000 inhabitants in 1944 was 150 as compared with 62.7 in England and Wales. It is universally recognized that these figures unfortunately understate the truth. It is estimated that there are 40,000 cases in Prague alone.

Previous efforts to control tuberculosis have been hindered by insufficient sanatorium beds and lack of adequate state financial help for the patient. As a result, the average stay of a patient in a sanatorium is only 3 months. Moreover, there is no adequate system of aftercare, and few tuberculosis health-visitors, so that the relapse rate is unduly high. Moreover, the service suffers from a lack of co-ordination in all its branches.

At the end of the war, there was a sharp epidemic (5,000 cases) of typhus in the concentration-camp at Teresin, but fortunately this was stamped out before spreading amongst the general population.

It is interesting to note that, in spite of the oppressive influence of the German occupation, the incidence of mental disease did not increase during the war. After the liberation, however, there was a sharp rise in the incidence of these diseases.

## Hospital Work

Many hospital buildings in Czechoslovakia are excellent—in fact, much better than the average building in Britain. In all hospitals, new and old, the wards are much smaller than in Britain, and the atmosphere is more friendly, although this is often at the expense of efficient nursing. Many hospitals were built during the First Republic. The Prague City Hospital in Bulovka is particularly fine, situated in the outskirts of the town, with each department in a separate building in extensive grounds. The chest department of Professor Skladal is excellent, and especially interesting is the infectious diseases department of Professor Prochazka (fig. 2). No suggestion ever made for the prevention of cross-infection by structural means has been omitted from this building. The Cancer Institute under Professor Moravěk in Brno (fig. 3, 4) is most impressive, and so is the State Hospital at Kosice (fig. 1). The Tatra sanatoria leave one amazed by their splendour, and many of the hospitals of the smaller towns, such as Usti and Labem, have excellent buildings, although some are not large enough for present needs. The older university hospitals were built many years ago, and often leave much to be desired in their construction. The

FIG. 1



The State Hospital, Kosice

FIG. 2



Prague City Hospital, Bulovka. Infectious Diseases Department

Prague University Hospital was built originally as a monastery in the time of Maria Theresa. In spite of this, many of the departments have been altered to make them adequate, and fine new buildings have been added, although the staff longs for the time when a completely new hospital will be built. The hospital at Olomouc is old and very small, particularly now that it has been converted into clinics. Some of the clinics in Bratislava, too, are housed in poor buildings.

The standard of diagnostic medicine in Czechoslovak hospitals is high, and only a few of the newest diagnostic methods are not yet available, e.g. bronchoscopic biopsy in cases of lung tumour. The high standard is in evidence everywhere, and I would mention, because I know them best, the clinics of Professors Charvat, Prusik, Hynek, Netousek, Syllaba, Henner, Vancura, and Podlaha, but one could continue the list indefinitely. The standard of pure pathology is very high, and I would cite particularly the work of Professor Sikl in Prague. On the other hand, the general level of treatment does not reach quite the same high standard. This arises largely from the fact that treatment has advanced relatively more rapidly than diagnosis during the war, and many new ideas involve a complete re-orientation of medical outlook, large-scale re-organization and

expense and the closest co-operation between all institutions associated with health-work. This co-ordination is poor in Czechoslovakia. Even within the boundaries of one hospital, each clinic or department is a self-contained unit, much more isolated from other departments than in a British hospital. This retards, particularly, the development of such a branch as rehabilitation. Therapeutics is at the stage where disease is treated, but no attempt is made to treat the patient as a whole, particularly with the aim of re-establishing full health, by active convalescence culminating in an early return to employment. Very few hospitals have convalescent departments.

Penicillin is distributed as in Britain, and excellent use is made of it. Sulphonamides, on the other hand, are used in smaller doses than those recommended in Britain and USA. This is largely because more-toxic compounds were used previously, and many doctors had unfortunate experiences with them which they do not easily forget.

Czechoslovakia is very fortunate in possessing many natural resources in the nature of springs, wells and waters, around which beautiful spas were built. Karlovy Vary (Karlovy Vary) and Mariánské Lázně (Marienbad) are now among the finest holiday centres in Europe. However, these possessions are not without their disadvantages, notably in tending to create an unbalanced sense of values in assessing relative merits in therapeutics.

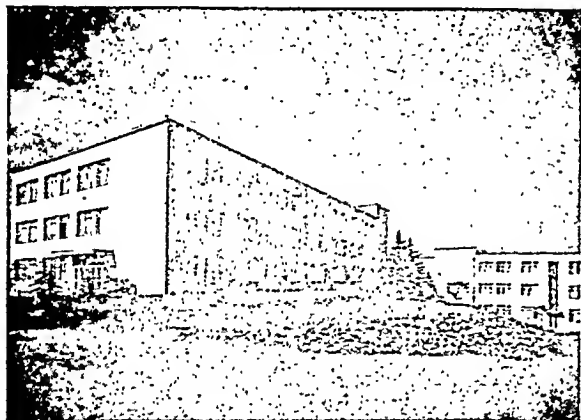
Surgical technique is excellent, but modern surgery is handicapped by three important factors. In the first place there is a complete absence of modern inhalation-anaesthesia. Wherever possible, local or spinal anaesthesia is used. Where a general anaesthetic is essential it is given by a nurse, using open ether. The surgeons are very conscious of this handicap, in particular Professor Jirasek of Prague, Professor Podlaha of Brno, Professor Rapant of Olomouc and Professor Carsky of Bratislava. Professor Jirasek has just sent an assistant to study anaesthetics at Oxford. Surgery is also handicapped by lack of specialization. Each surgeon is forced to be a general surgeon, and can spend only the time he has left over in working at his own speciality. However, here again much has already been done. Urology and orthopaedics have already long been recognized as separate departments, although fractures are still treated by the general surgeon. Other branches are rapidly developing. The world-famous plastic clinic of Professor Burian at Vinohrady Hospital, Prague, has been followed by the opening of plastic units in Bratislava and Plzen. Professor Divis in Prague is mainly interested in thoracic surgery, and the Government plans to encourage the development of this speciality by opening hospitals for the surgical treatment of tuberculosis. Departments of traumatic surgery already exist in Brno and Zlin.

The third great difficulty facing the surgeons, as indeed all hospital workers, is the shortage of nurses. This makes adequate nursing of the patients impossible, and particularly hinders good pre- and post-operative care.

#### Nurses

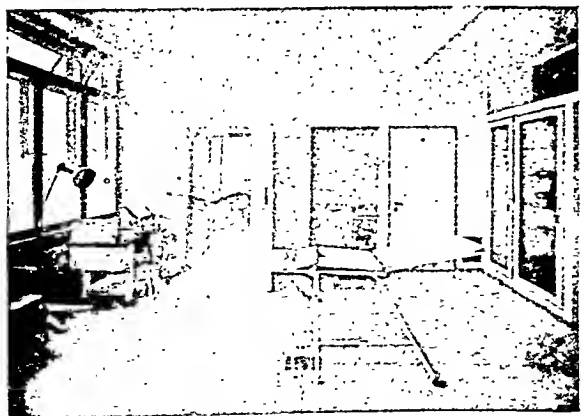
In 1937 there were 9,600 nurses in Czechoslovakia, 2,300 of whom were trained and 7,300 untrained (i.e. comparable to assistant nurses in Britain). Now there are only 7,050 nurses, 2,300 of whom are trained and 4,750 untrained. At least 2,500 nurses are needed immediately and 15,000 will be needed to man the planned extension of health services.

FIG. 3



Cancer Institute, Brno. General View

FIG. 4



Cancer Institute, Brno. Radium Therapy Department

The shortage of nurses arises from a number of factors. Before the war the value of a trained nurse was not so well understood as it is to-day, there was a great shortage of training schools, and the social status of a nurse was far lower than in Britain. Moreover, during the war, many girls who wished to be students, particularly medical students, took shelter in the nursing schools to save themselves from being sent away in forced-labour squads. These girls have now entered their chosen professions, and are consequently lost to nursing. The nurses' training schools are good. Nurses are regarded as students in Czechoslovakia, and live in a residential school where they receive theoretical training. Arrangements are made with local hospitals for practical training in specially reserved wards. The course lasts two years, and the nurse obtains a diploma at the end of this time. Although the training is good, it is often carried out under the most difficult conditions. The oldest training school is the State School in Prague, founded after the 1914-18 war by the American Red Cross. This school is excellent, but the buildings are so inadequate that one wonders how any girl is content to live in them. The school consists of 4 converted old houses, with dark rooms and long winding corridors. Five girls have to sleep in a room large enough for two, and two lavatories serve 60 girls. British nurses must admire these girls who are willing to suffer such discomfort to train in their chosen profession. However, a new building is already standing, and the nurses wait with great impatience the day when it will be ready for them to move in.

Before the war there were 8 such schools in Czechoslovakia, and 4 more were founded during the occupation. Since the liberation, no less than 12 new schools have already been founded, a great tribute to the determination and energies of the leaders of the profession. It is planned to establish 6 more in the next two years.

The profession is, in fact, led by a band of excellent women, with wide experience outside their own country. Success in the future lies in the further extension of the number of training schools to meet the increasing demand for nurses; in plans to give a theoretical training to untrained nurses now doing valiant work in the hospitals, and in raising the social status, living conditions, and conditions of service, of the hospital nurse. Although things look bad at the moment, I have every confidence in the future.

### Social Services

As early as 1926, a comprehensive state health-insurance was introduced into Czechoslovakia, including all types of employees and their families. Farmers, shopkeepers, and professional workers, who are not employees, are, however, excluded. Unfortunately, the system of insurance is very complicated, and it is difficult to give an overall picture which is in anyway accurate. There are many small state insurance companies, according to the type of work of the contributor, e.g. manual worker, clerk, post-office employee, etc. Each company has slightly different rates of contribution and benefit. However, the work of the companies is adequately co-ordinated.

The employee's contribution amounts to about 5% of his income, and the employer pays a similar amount. There is no state contribution unless the state is the employer.

The benefits include sick-pay from the 4th day of illness. The amount is reckoned as a percentage of wages, the lowest-paid workers getting 100% and the highest-paid only 50% of their earnings. The benefits also include free hospital treatment and convalescent treatment, free specialist consultation, drugs, appliances, spectacles and dentures; maternity benefit, burial benefit and old-age pensions. The insured person is able to choose his own doctor from the insurance list, providing the doctor is willing and able to accept him as a patient. In many areas, the insurance doctors work in centres, where also the specialists employed by the insurance companies hold their consultations.

Doctors are paid according to the number of sick insured persons consulting them per quarter. The quarterly fee is equivalent to 3 shillings per sick head. In addition to this, doctors receive payment for special treatment, e.g. dressings, injections.

The workers are also insured against accidents. The insurance includes accidents occurring during the journey to and from work. The benefits for permanent disability are paid monthly, and calculated according to a complicated scale of degree of disablement and original earnings. The contribution is paid by the employer.

Many of the other aspects of social service are not so well developed as they are in Britain. There is a large number of infant-welfare clinics, especially in the towns, but still too few in the country districts. These clinics are well attended and are appreciated by the people. On the other hand the antenatal clinics have never been very popular. There are many homes for orphans and handicapped children, and also a school medical service, although this is not so comprehensive as the British service.

Industrial health holds an important place in welfare work. The newer factories are all well-built from the hygienic point of view, with good ventilation, and adequate washing and cloakroom accommodation. Factory canteens are rapidly being established in all the bigger works. However, the guarding of machinery is not so adequate as in Britain, and the accident rate is higher. This matter is receiving close attention, and a big drive is being made, both by education and increased guarding, to decrease the number of accidents.

There are three big handicaps to welfare work. In the first place, it is unfortunate that doctors employed in public work, and also those employed in research, are paid very low salaries, and usually work on a part-time basis. This means that most of these doctors are forced to overwork themselves grossly by holding two posts at once, or by undertaking private practice. The strain of overwork and financial insecurity prevents the doctor from giving his whole attention to the planning and discharge of his public duties. Secondly, the number of social workers is quite inadequate, although they are well trained at the Masaryk School in Prague. There is, however, no person who undertakes quite the same work as that of the British health-visitor. Further, district nurses do not exist, leaving a great gap in the services, particularly in the country areas, where the level of hygiene is sometimes very low.

Finally, the services are not sufficiently co-ordinated and integrated with the general health-services of the country.

*Continued at foot of page 67*

*PROFESSOR CHARLES McNEIL was the first occupant of the Edward Clark chair of Child Life and Health in the university of Edinburgh, a post which he held for fifteen years until his retirement last year*

*His article contains personal views on some controversial subjects but, coming from such a source, they should command general interest and attention*

## CARE OF CHILDREN

### A Critical Review of the "Curtis Report"

Prof. CHARLES McNEIL

The report<sup>1</sup> of the Care of Children Committee published last September deals with a subject of great importance, in which public interest had already been aroused by cases

<sup>1</sup> [For title, particulars, and price, see *Book Reviews*]

<sup>2</sup> These statutes are The Poor Law Act 1930; The Children & Young Persons Acts 1933 & 1938; The Public Health Act 1936; The Adoption of Children Acts, 1926 and 1939.

of cruelty to boarded-out children, and in particular by the shocking details of a particular case. The Committee appointed by three Ministers of State in March 1945, under the Chairmanship of Miss Myra Curtis, had as its task—

"to inquire into existing methods of providing for children who from loss of parents or from any cause whatever are deprived of a normal home life with their own parents or relatives; and to consider what further measures should be taken to ensure that these children are brought up under conditions best calculated to compensate them for the lack of parental care."

This is a wide and complicated field of inquiry, and the Report fully reflects this complexity, as well as the painstaking labours of the Committee in bringing the inquiry to completion in eighteen months.

#### *Law, Administration and Statistics*

The first part gives an outline of the four<sup>2</sup> statutes that govern the care of homeless children in England and Wales, and of the administrative structure that has been set up to enact and control the provisions of these statutes. At the centre in Whitehall, the Home Office, the Ministries of Health, of Education and of Pensions, and the Board of Control all have a share in direction, with their local representatives and authorities in the Boroughs and County Boroughs. The multiform pattern of administration is determined by the differing categories of homeless children, and by the gradual evolution of state agencies dealing with them, beginning with destitute children gathered into work-houses under the Elizabethan Poor Law, and ending with war orphans of George VI committed to the Ministry of

## MEDICINE IN CZECHOSLOVAKIA

*Continued from page 66*

### *Future Proposals*

Czechoslovakia has drawn up a Two-Year Plan to establish her economy on a sound basis. A number of important medical measures is proposed. In the first place, there is to be considerable reorganization of the health services. Health clinics, similar to the British conception of a health-centre, have already been set up in the border-regions, and they will be extended to the major towns during the next two years. Three such clinics are already functioning in Kosice.

By gradual steps, the present complicated health-insurance schemes will be unified and the remuneration of the doctor raised. The state will take over the sale of drugs, and the spas will be taken over by the state, the trade unions and the insurance companies, to allow all classes of people to benefit by their facilities.

A major campaign will be launched to combat infectious disease. Diphtheria immunization will be made compulsory for the whole nation, at present it is compulsory in the city of Prague and in Slovakia. Plans have been drawn up to combat the widespread incidence of tuberculosis. The number of beds available will be increased by 3,000, and departments of thoracic surgery will be established. Attempts will be made to isolate highly-infectious incurable patients. Three large settlements will be established, inspired by Papworth Village settlement and under the guidance of Dr. R. R. Trail. Tuberculosis patients will have their incomes incremented by the state to the essential minimum, and school-children will be subjected to periodical skin-testing. The problem of the extremely high infant-mortality rate will be dealt with by establishing infant-welfare centres where they do not now exist. Ten will be established in 1947, and 10 in 1948. Children's departments will be established in all general hospitals. The methods of control, curriculum, and examination-standards of midwives will be revised. The present course of 10 months without previous nursing-training will be increased to two years.

The whole position of nurses will be revised. There is to be an increase in the number of training schools, the establishment of postgraduate diplomas, and the social level of the nurse will be

raised, with reference to her pay and living conditions. Attempts will be made to attract into the profession better-educated girls, and to train the untrained nurses now serving in the hospitals.

Mental-health clinics will be established, also V.D. clinics, anti-rheumatic clinics and cancer clinics. The industrial-health services will be extended, using the experience already gained in the excellent industrial-health service at the Bata works in Zlin and elsewhere. Finally, laws will be passed to insure the clean production, preparation, and sale of food.

### *Czechoslovak-British Medical Relations*

There has been a considerable increase of interest in British medicine since the war. After long isolation, Czechoslovak doctors have a tremendous interest in work that has been done abroad, and the many Czechoslovak doctors returning from Britain in the early days after the liberation brought back with them news of the medical advances during these years.

The British Council opened an office in Prague soon after the liberation. Supplies of medical and other literature were sent, and later a medical adviser was appointed to assist in establishing contact between the Czechoslovak and British medical professions. The demand for British books, periodicals, and lecturers is great, and it is the ambition of many Czechoslovak doctors to visit Britain sometime during the next two years. Very many are busily learning English, and attend anxiously classes in British medical terminology, run by the Council's British Institute.

Since the war a number of British doctors has visited the country, as guests either of the British Council, the Czechoslovak Government, or of medical societies. The most notable of these were Dr. R. R. Trail, Mr. G. C. Knight, Dr. J. A. Charles, Sir Philip Noel Panton and Dr. S. C. Dyke. They were warmly received and gave lectures to crowded halls. The Czechoslovak doctors want to know why Britain cannot send more lecturers. They would like Britain to send a team of 12, such as came from USA for two months during the summer.

At present an Anglo-Czechoslovak Medical Society is being formed; its inaugural meeting in Prague was called at very short notice, but no less than 110 doctors were present.

Pensions. This specialism in state and also in voluntary philanthropy, hitherto beneficent in its operation, is now a bar to further progress; and the Curtis Report recommends that the central administrative control of all deprived children, whether destitute, deserted, legally adopted, delinquent, physically or mentally defective, or orphaned should be vested in one department of central government. This single central department would draw up standards and rules and would supervise their operation by inspection and advice. This section ends with a statistical statement of the present numbers of children in England and Wales deprived of a normal home life and of their different categories. The total is 124,900: almost one half of this total is classed as destitute (57,600); of the remainder, the largest class are children removed from home by Order of Court, as delinquent, or in need of care and protection (23,400).

#### *Survey of Institutions and Foster-Homes*

The second section describes the many agencies and institutions, state and voluntary, which today attempt to meet the needs of these deprived children by providing a substitute for the home life they have lost; and which do so either by adoption, by boarding-out in selected homes, or by maintenance in institutions or children's homes. Further, it gives the result of an extensive survey by the Committee of the actual conditions in these institutions in all parts of the country and in many foster-homes where children are boarded-out. Of this survey, carried out by individuals and groups of the Committee, it is possible to give here only some of the general conclusions of the Report. Taking the institutional side, the Report states that the greater number of these community-homes were "reasonably well run from the standpoint of physical care"; while "some were very good, some indubitably bad." Where conditions were bad "the defects were not of harshness, but rather of dirt and dreariness, drabness and over-regimentation. We found no child being cruelly used in the ordinary sense . . ." But both in the detailed reports of the survey, and in the general conclusions drawn from it, the Report emphasizes the lack of personal interest and affection for the individual child shown in many Homes, and the serious effects of this on the personality of the children and especially of the older children, both in retarding the intellect and in stunting and distorting moral development.

These criticisms are applied both to voluntary and local-authority institutions. Other points of adverse comment are lack of equipment, lack of toys and playgrounds, poor accommodation, and deficiencies of the staff in personal qualities and training. There is strong criticism of the practice of keeping children in wards adjoining those of adults in old Poor-law buildings. The records of the children, apart from medical records, in nearly all institutions were very poor. The care of infants and young children under five was generally better than that of older children. Of the character of the Superintendents, Matrons and House-mothers, it is said with emphasis that "On the personality and skill of these workers depends primarily the happiness of the children in their care." Thus in paragraph 145, dealing with a nursery adjoining the wards of an adult workhouse it is noted—

"The relationship between the Master and Matron and children approached very nearly to normal home life. The Master made toys for them, played with them and joked with them.

He assured us that his Committee supported him in all his suggestions as to improvement . . ."

This paragraph immediately follows one describing another workhouse nursery with the worst conditions revealed by the survey, which has received much public quotation and notoriety.

Another example of the effect upon the children (in this case older children) of the right quality in the staff is worth quoting (p. 64)—

"There is a very happy relationship in this Home" [a cottage Home under Public Assistance] "between the foster mother and her 14 boys. She has been in the work for a number of years and obviously understands boys and how to get on with them. At the time of my visit some were playing halma with her and others were drawing with crayons or reading. The boys go out to the local Church Scouts and are also often allowed to go out by themselves by bus or to such amusements as the neighbouring fair."

These two examples are sufficient to endorse the comment of the Report on "the much greater importance of the personality of the staff than of any system by which the services were run". The definition of *personality* in this connexion may be given as a love of children; of this more will be said later in discussing the qualifications and training of the staff of these institutional homes for children.

#### *Foster-Homes (Boarding-out)*

In view of the O'Neill case [a notorious case of ill-treatment by foster-parents], the survey and conclusions of the Committee on the condition and well-being of children maintained for reward in the homes of foster-mothers are reassuring. Here there was little or nothing of the dullness and loneliness of spirit found in the institutional homes; "indeed the foster homes as a whole made a decidedly favourable impression." But the cautionary remark is made that the risk remains of instances of incompatibility between the foster-parents and the child, and of "acute unhappiness" in the child: and various criticisms are made of faulty and loose administration of local authorities which would allow these exceptional cases to go undetected.

#### *Recommendations*

The recommendations cover every aspect of the problem of all classes of children deprived of their homes—legislation; central and local administration; and the placing of the children in new homes by adoption, boarding-out, and group-treatment in institutional homes. Again it is possible in this review to make only a selection of these proposals, and to sum up in a final commentary.

The recommendation of a central single Ministry with suitable staff, and with powers of framing policy and supervising its execution by a special *ad hoc* committee of all local authorities has already been mentioned. All voluntary organizations and homes dealing with these children should be registered, subject to inspection by the central department, required to conform to the rules and directions of this department, but otherwise permitted to continue their present work.

Each local-authority committee should have a Children's Officer, with special experience in child care, preferably a woman, who would be responsible for the welfare of all deprived children in the area; and where necessary this Children's Officer would act for several Children's Committees in combination as a Joint Board; her appointment



should be approved by the central authority, and her annual report to the local committee and council should be sent also to the central authority; her responsibility for the children under care would be delegated to a staff of women, each of whom would maintain personal contact with a group of children.

Adoption first of all, and then boarding-out make better provision than institutional care; and the children's officers should be responsible for receiving and investigating cases, and through the assistance of trained visitors for placing the children in suitable homes. A vigorous attempt should be made to increase the boarding-out service.

In institutional homes, none should form a structural part of adult institutions managed by public assistance departments of local authorities. In the case of infants, their nurseries should be in the charge of medical specialists. In the Homes for older children, ages and sexes should be mixed, and the number in any Home should not exceed 12: the education of these groups of children should be in neighbouring primary and secondary schools. Every assistance should be given to the children in choosing their future work, and more attention should be given to the after-care of the children when they leave the residential homes.

The number of deprived children at present under public care should be increased by including adopted children, by extending the age of boarded-out children under supervision from 9 to 16 years, and by registering all children in voluntary Homes. It is calculated that these additions would bring the present total of 125,000 deprived children in England and Wales to 150,000 or 200,000.

Other recommendations deal with physically- and mentally-defective children, with approved schools and remand homes, and with emigration.

#### Commentary

The report is a valuable document and also an ominous social landmark. It contains a mass of important information; and both in arrangement and presentation it reflects much credit on the industry, ability and moderation of its authors. It deals with problems and issues of the widest interest and of deep national importance; and its proposals should receive thorough and also critical examination.

The problem it deals with is the mitigation of the evils that must befall children who for any reason are deprived of home and family life. The number of these children, already large, is increasing; and although the immediate question is the alleviation of their lot, the more fundamental question of the causes that lead to the breakdown of family life raised at the beginning of the Report, is admitted to be of the utmost importance, but is left aside as falling outside the terms of reference.

#### Foster-Parents

The success of these measures of alleviation depends above all else on the moral qualities of the new guardians of the children who assume the duties of parents. This is clearly stated in the Report and will receive universal agreement. Everyone also will agree that these foster-parents, whether in real homes, or in institutions, should be supplied with all proper facilities of accommodation, equipment, and service, necessary for child life, and should be subject to inspection and supervision in performing their duties. Many faults of this kind, in bad environment and in loose

and faulty inspection, are pointed out in the Report, and can be remedied without drastic changes in the existing machinery of administration. But the best results will be attained only if the women and also the men, who are *in loco parentum* have in high degree the feelings of parents towards their children, and not only affection but also obligation, and the power to win from the children answering affection, trust and obedience. Where these qualities are present, the inspecting functions of the state ought to be unobtrusive and should leave a large measure of freedom and diversity of training methods to those in charge of the children.

#### Powers of Central Department

The appointment of children's officers, preferably women, throughout the country in areas of suitable size is a valuable proposal of the Report. The other proposal of a single central department determining general policy, drawing up standards and rules and with a staff of inspectors, may be logically-sound on paper but has the usual dangers of centralization—a deadening uniformity of policy and methods, and the weakening of local interest, initiative and responsibility. A graver danger is the hasty and ill-considered application of doctrinaire theories to the moral education and character-moulding of children, and their enforcement on a national scale. Thus the Report favours a more lenient discipline of children in their substitute homes and gives many examples of its views in this matter; and at the same time it places in Whitehall the right to draw up and enforce the rules for the home discipline of these children. It proposes further that all *legally-adopted children should now be subject to inspection*, and presumably to the enforcement of the central code of child-discipline and training. From this it is only a short step to state inspection and control of children in all families, when we shall have arrived at complete *étatisme* in family life.

#### Discipline

The training of children at home, which is discussed both in principle and in detail in the Report, is of great importance—"the child is father of the man". The first quality in good parents is love of their children; second, but still cardinal, is proper discipline and control. In the Committee's survey of foster-homes and institutions, which was extensive and searching, no case of cruel or savage discipline was found; but while many good and acceptable proposals are made for relaxations of unduly strict routine and discipline, including the caning and birching of boys, there is no mention of the importance of discipline as a whole (p. 168). This is a regrettable omission; and especially as the increasing delinquency in children is believed to be largely due to the lack of control and discipline in their home life. In this hard and difficult world, and as the right preparation for their taking a robust part in it, the time has come for a return to a stricter code of discipline in the family life of children. And in institutional "homes" a good standard of discipline is even more important, and those in charge should be enjoined and encouraged to maintain it. Good discipline is compatible with freedom and happiness. The Report rightly insists on the primary importance of affection and affectionate personal interest in those in charge of Children's Homes, but it does not

*Continued at foot of page 70*



*Dr. R. A. McCANCE is professor of experimental medicine in the university of Cambridge. He is well known for his nutritional work, and during the war he was directly engaged upon the experimental study of rationing problems*

## FOOD CONTROL IN BRITAIN 1939-1945

Prof. R. A. McCANCE

The task of feeding any country during a time of stress depends upon the application of established nutritional principles to the particular problems by which the community finds itself faced.

In 1939, Britain depended upon imports for more than half her food, and the experience of 1914-18 indicated that supplies were likely to become critical in the next few years. At the same time, the extensive knowledge of nutrition which was available in 1939 indicated that it was more economical to grow food for direct consumption by man than to utilize it for rearing pigs, poultry and cattle. It was also known that men, women and children required different

kinds and amounts of food, and that in times of shortage each might have to be considered separately. Armed with these general principles, the Ministry of Food faced its task in 1939 and has now published a summary of its activities.<sup>1</sup>

Most people who live in Britain would agree that, on the whole, the country has been well served by the Ministry of Food. At first its task was comparatively easy, for relatively few ships were being destroyed by the enemy, and most of the countries from which Britain was in the habit of drawing her food-supplies were still able to export food. In 1940, however, the fall of Denmark, Norway, Holland, Belgium and France completely altered the situation, and with the entry of Italy into the war the position became extremely grave. Nevertheless, throughout this time the stocks of food in Britain were steadily being increased by the Ministry in anticipation of difficult times ahead, and the wisdom of this step was apparent in 1942, when the accumulated stocks of food had to be drawn upon to the extent of 700,000 tons.

In order to increase the food supplies of the country, land was broken up for the production of grain and vegetables, and the pig and poultry populations were drastically reduced. The number of cows, however, was not only maintained but increased to meet the greater demands for milk brought about by the generalized issue of milk to children and its provision for invalids. It is difficult for the "ordinary consumer" of Britain to-day, rationed as he is to about 1 litre of milk per week, to realize that the milk supplies of the country as a whole have increased since 1939. The extraction-rate of wheat was raised from about 70% to 85%.

<sup>1</sup> [For title, particulars, and price, see *Book Reviews*]

## CARE OF CHILDREN

*Continued from page 69*

give discipline its proper place alongside the first. The best mother is she who joins with loving care a discipline which is both strict and gentle: and this should be the model for the institutional "mother". Undue severity of discipline can be detected and corrected by a proper system of inspection. Horace describes the hardy children of the old latin peasant families as "*severae matris ad arbitrium*"—"under the unquestioned rule of a strict mother".

### *Religion*

The place of religion in the institutional home-training of children is discussed in a short and colourless subsection of ten lines (paragraph 493), and is the subject of a minority reservation. And yet, all over the world and through all recorded history, religion is and has been one of the great disciplines of life. Its practical omission from the Report no doubt reflects the popular modern view that religion is beyond the grasp of the child's mind, and also the prevailing practice of that view. In the reservation (p. 183) it is stated, "From their earliest years they [the children] need the help which is found in a growing faith." This general statement is supported in the Report on Primary Education in Scotland recently published (Cmd. 6973), where modern educationists assert that the child's mind is deeply interested in the mysteries of life and is eager to receive instruction and guidance in religion. And there is Wordsworth's great Ode on *Intimations of immortality from recollections of early childhood*, which is full of the same theme. So that there is authority, both ancient and modern, as well as the vast experience of mankind, for giving religion a high place in the training of homeless children. In the Report this matter is expressed only as

a wish and a hope that the staff in charge "will no doubt find means, as good parents do, of influencing the children's lives both by their teaching and their example."

### *Effects and Causes*

The care and training of deprived children are only palliative remedies. They do not touch the disease that has produced these thousands of homeless children—the existing widespread corruption and disintegration of family life. But if proper remedies will mitigate the effects of this disease of the family, the same remedies can and will cure the disease itself and restore the health of the family. In this sickness of family life, there are many injurious causes at work. One of them is lack of family discipline. Another, and more important, is lack of religious training, which is the most comprehensive of all disciplines, and which penetrating the life of the young child from his early years will bring him to the full stature of manhood. Wordsworth has given the right formula for the health of the family—"pure religion breathing household laws."

The Report is a most important document of social study and contains many valuable proposals which should result in the better care and training of homeless children. It raises issues which go to the root of national well-being, and which require thorough examination and discussion. In this commentary three matters have been selected which the writer believes to be objectionable and to require critical discussion: the excessive powers given to a central department over the training of deprived children; the lack of positive proposals for good discipline in Children's Homes; and the perfunctory place given to religion in the training of the children.

Difficulties due to the shortage of shipping were not the only problem which faced the Ministry of Food. Owing to the manpower-shortage within the country, and, to some extent, to enemy-action, the distribution of food had to be completely reorganized. The principle of "zoning" was introduced, by which foods produced in one part of the country were allocated for consumption there, regardless of trademarks or goodwill. Retail distribution of food had to be curtailed. Milk, for instance, was delivered only once a day, and in some places not so often.

All these adjustments were made possible by an extensive system of controls. It was relatively easy to control the foods which were imported from abroad, but much more difficult to control the food produced within the country, yet it was essential to do this. It was arranged, therefore, that all food except fish and green vegetables should be sold either to the Ministry or to accredited agents. The pigs, for example, had to pass through special slaughterhouses or bacon-factories, and the eggs through packing stations. All this was made possible only by the recruitment of acknowledged experts in all the trades to be controlled, and on the whole it must be said that these people have served the Ministry well.

To prevent a sharp rise in the "cost-of-living index", upon which many wage agreements had been based, the prices of retail foods were controlled from the beginning of the war. It was, naturally, possible to hold prices steady only at the expense of the Exchequer, and a most elaborate system of price-fixing was necessary at all stages of distribution. In the first year of the war, the subsidies cost the Exchequer £13.2 million; in 1944-45 £168.4 million.

The requirements of the individual were met by a system of rationing. Meat, bacon, cheese, fats, sugar, preserves and tea were issued in fixed amounts obtainable only on the production of the specific coupons. Tinned meat and fruits, dried fruits, dried pulses, condensed milk and a number of other processed foods were sold on the "points" system. Each individual was issued with a certain number of "point" coupons per month, and all foods sold on the "point-coupon" system were rated at so many "points". This enabled the housewife to select from the foods so sold those she preferred, and it gave an over-all ration with a limited individual choice. The system was a success. In addition, special coupons were issued to each individual for the purchase of sweets; while milk, shell-eggs, oranges and one or two other foods were allocated by controlled distribution. The special requirements for children, and pregnant and lactating women, were met by the issue of

special ration-books; but with bread and potatoes always unrationed, and with the special canteen-facilities which were provided in many of the industries, it was never necessary in Britain to have special cards for heavy and very heavy workers. Anyone could have a meal in a restaurant without surrendering coupons. These were very great advantages, and there is no doubt that these two freedoms contributed in no small measure to the efficiency of the country throughout the war.

Difficult as the task of Ministry of Food must have been, it would have been many times more difficult had it not been for the goodwill and co-operation of the people. The country was never overrun by the enemy, nor was there ever any real shortage of food. People may have gathered more blackberries than they did before the war, but they were never reduced, as in Holland, to eating tulip-bulbs and sugar-beet. Thanks to this and to the mentality of the British public, there was never any risk of a big black-market.

The situation in Britain was not unlike that in Switzerland. In 1939 both countries imported more than half their food. Their problems were similar and they were solved in very much the same way. Land was brought into cultivation; livestock was reduced in numbers. The extraction-rate of bread was raised; the consumption of potatoes and cereals increased, while that of fats, meat and sugar was reduced. The Swiss did not maintain their supplies of milk at their pre-war levels, and bread was rationed, but there was never a serious blackmarket. The calories per head were never so high in Switzerland as they were in Britain, and at one period in 1944-45 they fell to a level incompatible with good health.

The British people have much for which to be thankful. They have been well, if somewhat monotonously, fed throughout the greatest war in history and during times when much of the world has been facing starvation or semi-starvation. But producers and consumers alike look forward to a relaxation of those controls which they regarded as unpleasant necessities during the war. Producers wish to be free to sell to whom they will. Consumers welcome the application of nutritional principles to the feeding of their children. They wish their boys and girls to have milk in school, if it is good for them, but they want more milk for their own tea, and they want to abandon their ration-books for ever, and to buy what they want, where they want and when they want. Let us hope that these times will come soon, not only for the people of Britain, but for all the peoples of Europe and Asia who have suffered from the war.

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## PUBLIC HEALTH IN BRITAIN 1939-1945

Dr. A. C. STEVENSON

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The report<sup>1</sup> of the Chief Medical Officer of the Ministry of Health for the years 1939-1945 is a worthy new member of a great family—the family of the reports of the principal medical officers of the central departments concerned with public health. It is in direct line of descent from those of Sir John Simon of seventy years ago, and like these ancestors will not disappear to lie and become dusty, forgotten in the basement of the reference-libraries, but rather will become much tattered by use.

Sir Wilson Jameson outlines in his introduction what is to be expected in the body of the report and indicates who is mainly responsible for the sections. He pays generous tribute to the work of the members of his own department, to his Medical Advisory Committee, and to Medical Officers of Health with the Local Authorities.

It is quite impossible in the space available here for the reviewer to do more than mention the highlights of the various sections, for there is too great a mass of information. If he can interest readers sufficiently to make them refer to the original, he will more than adequately have performed his function.

### I. Vital Statistics

The figures for general and specific mortality, outlined by Dr. Percy Stocks, show how remarkably good was the general health of the British people during those difficult years. Those rates which are usually regarded as providing an index to social conditions—infant mortality, maternal mortality, infectious diseases of childhood, etc., have all shown steady substantial reductions during the period reviewed. The birth-rate rose steadily, and the only cause of general mortality which shows significant increase is called "operations of war."

The feared epidemics did not arrive, apart from a great increase in the incidence of cerebrospinal fever in 1940, which has since slowly decreased. This was to be expected when so many young adults, and not a few children, were living in herds. Even tuberculosis, though it showed a substantial increase in 1940, has now fallen to pre-war levels.

### II. General Epidemiology

This section was compiled by Medical Officers of the Ministry concerned with infectious-disease control.

Smallpox and postvaccinal encephalitis are discussed,

and the bearing of experience on the policy of compulsory vaccination is clearly responsible for the stopping of compulsory vaccination by the National Health Services Act.

On diphtheria, the writers, while welcoming the steady reduction and associating it with the diphtheria-immunization campaign, point out how much more complete must be the immunized state of children before results comparable to those of North America will be achieved.

The effects of war-conditions and of new forms of treatment (especially for cerebrospinal fever) are discussed in relation to all the other infectious diseases. Some twenty cases are reported of indigenous malaria spread by *Anopheles maculipennis* var. *atroparvus*. It is surprising that there have not been more cases, when the number of troops returning from malarious areas is considered in conjunction with the neglect of drainage in certain saltmarsh areas occasioned by the war. In the note on tuberculosis, reference is made to the Medical Research Council's Committee on Tuberculosis in War Time, to the special problems of the military services, and to the use made in these services and in industry of mass miniature radiography. The present position and the challenge is well stated as: "pulmonary tuberculosis has hitherto been discovered at a stage later than that in which radiography has now made diagnosis possible."

The position of the civilian patient who, as a result of mass miniature radiography, was discovered to have a tuberculous affection of the lungs and who felt perfectly well and was unwilling to give up his livelihood, made necessary an insertion in social legislation providing for maintenance-allowances in certain circumstances. It is well recognized that the future value of mass radiography will depend on whether a sufficient provision of hospital and sanatorium beds can be made available for cases discovered.

The wartime increase in venereal disease is discussed especially in relation to the limited notification and compulsory-treatment powers over persons suspected of spreading widely the infection, while the section on cancer, rheumatic affections, scabies, and pediculosis, all have considered analyses of statistics and of the results of recent experience.

### III. The Emergency Public Health Laboratory Service

This service, planned by the late Professor W. W. C. Topley and subsequently directed by Professor G. S. Wilson, is welcomed as a wartime scheme which has proved too valuable to be dispensed with in peace. Its value lay essentially in that the many local laboratories were enabled to keep closely in touch with Medical Officers of Health and to build up a regional bacteriological field-service. There were three central laboratories, ten (subsequently reduced to seven) constituent Emergency Public Health laboratories, and a large number of university, voluntary-hospital and local-authority laboratories, which by agreement worked in the scheme. The special investigations carried out are listed in the text.

### IV. Maternity and Child Welfare

This section is divided into two parts: A. *Nutrition of mothers and infants*, and B. *Evacuation of school children and others*.

<sup>1</sup> [For title, particulars and price, see *Book Reviews*]

Section A is by Dr. Dorothy Taylor, and it covers the special wartime problems of evacuation of mothers and children, of the care of children evacuated without their mothers, of the provision of day-nurseries for the children of mothers in industry, and of many other arrangements which had to be made for the welfare of mothers and children.

There are some interesting tables compiled, on lines now well-known in previous reports, from detailed reports on cases of maternal deaths, but it is disconcerting to note that in only about one-half of the cases of death of a mother associated with pregnancy was a detailed report received. The statistics are invalidated completely and future statistics will also be valueless unless all cases are analyzed. It is hoped that in the National Health Service this will be remedied.

Section B by Dr. E. L. Sturdee outlines some of the social aspects of the evacuation of schoolchildren as well as refugees of all ages. Some of the experience gained has been most valuable, notably that concerning the handling in hostels of "difficult" children.

### V. Food and Nutrition\*

The story of British food-rationing, reviewed by Dr. W. A. Lethem, during the war is one of which we are proud. The irksomeness of it then (as now) receives plenty of comment, but its fairness has seldom been questioned, and this was one of the big factors in morale.

The administrative system is of personal rations for basic foods, with points varying in value for less-essential foods as the latter are available, while the pregnant woman and the nursing mother and her children are given the necessary extras. The system is founded on the three cornerstones of scientific assessment of needs, of social justice, and of rigid control. That the scientific assessment and recommendations for supplying special needs were sound, seems to be indicated by every investigation which has been made to assess nutrition.

### VIA. Emergency Hospital Scheme

Sir William Jameson in his general introduction says:

"It is hardly possible to forecast now which parts of the Emergency Hospital Scheme will prove in the years to come to have contributed most to the health services of the country."

Sir Francis Fraser and his fellow-authors show that co-operating in the scheme were every type of hospital in the country—voluntary, local-authority, teaching hospital, and the new hospitals established at the outbreak of war. It was necessary to allot medical men arbitrarily to hospitals, and to pay salaries to the honorary consultants of voluntary hospitals who had to work in the new scheme. The aims were stated as (p. 127):

"(1) To make available approximately 300,000 beds in hospitals for civilian casualties and all Service sick and casualties for which provision could not be made by the Services. The Services' contribution was expected to be about 30,000 beds in the whole country.

(2) To provide out-patient and hospital treatment in casualty clearing hospitals in vulnerable areas, and in fully equipped base hospitals outside vulnerable areas.

(3) To treat in special hospitals, fully equipped and staffed by experts, certain types of injury and disease.

(4) To provide adequate accommodation in hospitals for medical cases and for convalescents not requiring the resources of a fully equipped hospital.

(5) To appoint Consultant Advisers to the Ministry, Regional Consultants to the Regional Hospital Officers, Regional Consultant Advisers on special subjects, Group Officers in large provincial towns and Group Advisers to other groups of hospitals in order to ensure the most efficient standard of treatment of casualties in all EMS hospitals with the view of attaining as quickly as possible the return of casualties to the highest possible degree of physical fitness."

It seems likely that these aims are easier to state now than they were in 1939!

In the early days, large numbers of beds were kept empty to receive air-raid casualties and sick military personnel. Fortunately, the former never reached the high numbers expected, so that in addition to providing accommodation for a high proportion of all military cases, the hospitals came more and more to be used for dealing with ordinary civilian patients. When civilian casualties did begin to occur, the EMS met all requirements.

Similarly the arrangements for reception of convoys of sick and wounded military cases from overseas were undertaken, so that by D-day the authorities had enormous experience of individual and group hospital administration. As a result they were never flooded, and their organization for the reception and distribution of wounded earned the well-merited thanks of the men.

The development of special centres for plastic surgery and jaw injuries, neurosurgery, orthopaedics, etc., gave valuable experience for peacetime needs, though perhaps it will be a mistake to draw too directly from such experience.

The following quotation invites some scepticism—surely we hear the same in any service in any land.

"The chief objections to the scheme on the part of the hospitals arose from the numbers of circulars and instructions which had to be dealt with, and the number of forms and returns which had to be completed. During the inception and evolution of a service of this kind, the functions of which were constantly expanding, and in the working of which many alterations had to be made from time to time in the light of experience, the issue of many instructions and amendments thereto was unavoidable. As regards returns and forms, all were found to be necessary for the purposes of records and statistics, but their completion undoubtedly threw a heavy strain on the depleted staffs of the hospitals. This state of affairs, attributable to war conditions, would not obtain to the same extent in normal times, and would have been less burdensome if a more generous establishment of clerical staff could have been authorised." (P. 157.)

That "all [returns and forms] were found to be necessary for purposes of records" makes it clear that those who called for returns were gifted to a degree uncommon in mortals!

Another statement which leaves an uneasy feeling is:

"The inconvenience caused to patients by their treatment being carried out in hospitals at some distance from their homes is unavoidable, but is of minor importance in view of the benefits patients receive under this system.

The Emergency Hospital Scheme therefore provides an example of a system under which the interests of the State, the hospital authorities, the medical profession and above all the patients were as fully provided for as the somewhat restricted resources in the circumstances imposed by war conditions would permit. It would appear to have been appreciated by all concerned." (P. 157.)

\* [See BMB 1029 in this number for a review of wartime food-rationing.—Ed.]

## VIB. The Hospital Pathological Service

This service was set up by Dr. P. (now Sir Philip) N. Pantou and is described by him in the report.

Before the war, in conjunction with the British Medical Association and the Ministry of Labour, a national register was formed of all people (about 2,500) working in hospital laboratories.

In "designated" laboratories, the whole cost of the service was borne by the Ministry. The "non-designated" laboratories were those which received payment for work done, the sector pathologist having a purely advisory and consultative interest.

The early survey, and those carried out after war started, showed that in the smaller country hospitals, laboratory and staff provision was quite inadequate. The system adopted was to make as many regions as there were medical schools, to appoint the professor of pathology as honorary adviser for each area, and thereafter to make the best possible arrangements with the manpower available in the areas.

*The civilian blood transfusion service.* A regional blood-transfusion service was set up under the Emergency Medical Service (EMS), and blood-banks were established in provincial cities, associated when possible with a university.

This service, which is now a well-established regional organization of the Ministry of Health, has been an immensely valuable gain. Its present availability, to say nothing of future expansion, is of immense service, and is likely to prove essential to the study of the distribution of the Rh and other blood-group factors.

## VII. Civil Defence Casualty Service

This section, while of great historical interest and of future value, in that it gives an account of sociological experience in the needs of old people, will not be reviewed as most people are familiar with the story of the air-raid casualty, and the problems of the air-raid shelter and of the homeless.

## VIII. Problems of Medical Man-power

The problem of the correct allocation of manpower for civil and military needs arose early in the war, and in December 1940, a government committee was appointed to consider the matter. As a result a central and regional medical manpower committee organization was established and, by compromise, a reasonably fair distribution was always achieved.

## IX. Dental Services

The National Health Insurance and Maternity and Child Welfare Dental Schemes carried on under severe handicap during the war. Fruitful collaboration of dentists and surgeons in the special centres for maxillofacial injuries resulted in special courses, notably at the Queen Victoria Cottage Hospital, East Grinstead, where the training given to specialists enabled them to carry out excellent teamwork both in the armed forces and in EMS hospitals.

## X. The Nursing Services

The shortage of trained nurses and recruits to the profession

is likely to be one of the major difficulties encountered in the provision of a National Health Service.

A Nursing and Midwives Division was created in the Ministry of Health in 1941 to deal with general and professional questions. A Chief Nursing Officer and two Deputies at the Ministry are represented by 21 women inspectors, 12 regional nursing officers, and 11 deputy regional nursing officers.

The inspectors' work in supplying nursing needs and services in wartime is to be continued, and they also have as duties the inspection of maternity and child-welfare schemes of local authorities. The duties of the inspectors are not given in sufficient detail for a Medical Officer of Health (or indeed any reader) to judge the probable value of inspectors in the future. There is an excellent account in this section of the present difficulties and the attempts to meet them.

## XI. Morbidity Statistics

The well-known lack of statistics concerning morbidity as opposed to mortality has troubled all British medical statisticians and planners from John Graunt and William Farr onwards. Dr. Percy Stock's analysis of a sample of 45,000 cases ( $\frac{1}{2}$  of total) admitted to EMS hospitals in 1942 and 1943 has therefore been eagerly awaited, as will be the promised more-complete estimates when time permits analysis of the other records.

The age- and sex-incidence of acute and chronic, severe and mild diseases, and the duration of disability, are analyzed in a series of tables. The following extracts are from those chosen by Dr. Stocks himself:

"... *Neoplasms* accounted for 17 per 1,000 non-infective and non-respiratory diseases amongst men and 32 amongst women, the rates increasing rapidly with advancing age. *Diabetes* rates were only 1 or 2 for men under 45, increasing to 36 at ages 55 and over. *Anaemias* showed a rate of 9 per 1,000 women compared with 1 for men. For *Psycho-neuroses* and functional digestive disorders together the rates amongst men of the 5 ages were 81, 107, 109, 94, 18 in 1942 and 79, 98, 115, 88, 19 in 1943, reaching a maximum at 35-44 and then falling; amongst women the rate was about 80 at each age under 35. *Eye and ear* conditions gave rates about 11 and 27 respectively for men; compared with 8 and 21 for women. Diseases of the *heart and arteries*, together with cerebral haemorrhage, showed rates increasing rapidly with age after 35. For diseases of the *veins* men's rates were much higher than those of women, averaging about 80 at all ages and reaching a maximum at 35-44. *Acute sore throat* showed a remarkable decline with advancing age for both sexes, rates being about 100 at ages under 25, falling to about 40 at 35-44 and 20 or less after 45. This was true also of acute *hepatitis and jaundice* amongst men; and 1943 rates were considerably higher than in 1942 for both sexes. *Hernia* rates amongst men varied little with age up to 55, being about 60, compared with 4 for women.

*Gastric and duodenal ulcer* rates for men were as follows:

		15 -	25 -	35 -	45 up	All ages	Scottish
Duodenal	1942	17	31	44	52	29	52
	1943	12	28	44	32	26	45
Gastric, etc.	1942	3	8	16	8	8	9
	1943	3	7	13	23	7	3

Out of 1,623 at ages under 45 there were 1,278 with duodenal ulcer, giving a ratio of 1 gastric to 3.7 duodenal, pyloric ulcer being included with the former of which they formed 8 per cent. The total ulcer rate for women under 25 was only one-sixth of that for men of the same age group, and at 25-34 one-tenth." (p. 217).

To appreciate their value fully, the tables must be studied in detail.

Continued at foot of page 75

# USAGE OF DDT

Dr. J. R. BUSVINE

*London School of Hygiene & Tropical Medicine*

The story of the discovery and development of DDT as an insecticide gives an interesting impression, not only of the ramifications of applied science, but also of the complexities of modern needs. Nowadays all kinds of people require insecticides for coping with a great variety of pests whose attacks and depredations were formerly regarded as inevitable. DDT has received a great deal of publicity and has become very widely known. But there has been a danger that too much adulation will lead to disillusionment, for DDT has its limitations and it must be properly used. It does not act, for example, as a fumigant or repellent; it must come into direct contact with an insect to kill it. Therefore puffing DDT solution or powder into a wardrobe cannot be relied on to protect clothing from moths unless each garment is properly impregnated. Again, the rather slow action of DDT may give rise to disappointment.

If it is useful for the general public to understand the proper doses and ways of using DDT, such information is essential to scientific, medical and sanitary officials who deal with insect-pests. But so rapid has been the enlargement of the field of knowledge about DDT that these men have found it difficult to keep abreast. The comprehensive summary<sup>1</sup> of Campbell & West of published work on DDT up to 1945, is therefore very welcome.

After a historical chapter, the first section of this book deals with DDT rather from physical and chemical aspects.

The methods of manufacture, reactions of DDT and analogous compounds and, especially, methods of preparing it for use, are considered in detail. On the whole, this section is excellent, though perhaps some caution is necessary in interpreting the results observed with formulations which are still undergoing trial. For example, the incorporation of DDT into paints and certain other materials does not yet seem to have been clearly justified. The next section of the book reviews the results obtained against a variety of insect-pests, the original papers being summarized very briefly but usefully, with emphasis on quantitative data. These pests are grouped into chapters in accordance with their relations to man, which is convenient; but it is less easy to justify their arrangements within the chapters in the arbitrary alphabetical order of common English names.

A summary of information about DDT of a somewhat different type is available in a pamphlet produced by the Ministry of Supply.<sup>2</sup> Within quite a small compass there are many data useful for compounding and using the insecticide (e.g. lists of solubility in different liquids). The experimental results against various insect-pests are given briefly; the list of pests against which DDT has been used is imposing but not really helpful. However, there are general directions for dealing with different types of pests and quantitative data for common ones. In the appendix there are given some "typical formulations," but perhaps too much emphasis is laid on aerosols which do not utilize the persistent residual powers of DDT.

As summaries of research on DDT, these two publications cannot remain up-to-date for very long, but this fact does not greatly detract from their value. Both of them give many chemical and physical data which are required for preparing and using DDT. They give formulae for practical applications which have in most cases been established as workable even if they are not the best possible. The book by Campbell & West gives in addition a comprehensive account of all the early work on the subject which ought to be consulted before embarking on further research.

<sup>1</sup> [For title, particulars and price, see *Book Reviews*]

<sup>2</sup> [For title, particulars and price, see *Book Reviews*]

## PUBLIC HEALTH IN BRITAIN 1939-1945

*Continued from page 74*

The second source of morbidity statistics which is available as a result of the war is the figures of incidence of sickness in a random selection each month of about 7,000 persons between 16 and 64 years of age. The War-time Social Survey placed its organization and field-workers at the disposal of the Ministry for the experiment which began in the winter of 1943-44. Subsequently older people were included. The survey is continuing, and the next step will be to include children.

In this case also, to abstract is impossible—the information is already compressed in the report.

### XII. Advances in Therapeutics

There is nothing new in this useful survey by Dr. W. P. Kennedy, of the advances in chemotherapeutic agents, antibiotic substances and the new insecticides, but it is well worth reading because of the information given about the steps taken to meet such pressing problems as the loss of javanese quinine, the commercial production of penicillin, etc.

### XIII. International Health and Medical Intelligence

Dr. Melville Mackenzie in this section shows how some of the difficulties were met of collecting information about epidemic conditions in enemy-occupied countries, and how the Ministry of Health fulfils its obligations under the International Sanitary Convention 1926.

## XIV. Environmental Hygiene

This is short, and deals with the work of the Ministry connected with wartime building, air-raid shelters and the Water Act 1945, which is framed to provide in all rural areas a piped water-supply.

## XV. Health Publicity

It is delightful to discover that the national newspapers refused to allow advertisements which said "Always wash your hands after using the W.C."

## XVI. Planning for the Future

This section was written by Dr. J. A. Charles before the publication of the Bill which became the National Health Services Act in November, 1946, so that it is aligned on the White Paper issued by the Coalition Government in February, 1944. Nevertheless, it is an excellent summary of the situation which made a National Health Service inevitable, and as such should be read by all who would understand the full implications of the new Act.

The surveys and preliminary planning which began in the dark days of 1941 illuminate the faith in a bright future which was also so conspicuous a feature of the Beveridge Report. Without the results of regional hospital-surveys carried out in 1941-45, the establishment of the hospitals service would have been delayed by just so long as it would take to carry out, digest and discuss new surveys.



# Annotations & News

1032

## SOCIAL MEDICINE AT OXFORD

The Institute of Social Medicine, Oxford, came into being with Professor John A. Ryle as director in April, 1943, but it has published only one annual report<sup>1</sup> as, because of staffing and accommodation difficulties, 1945 represents the first year of work.

The purposes of the Institute, as laid down in the Resolution of the Trustees, are as follows: (a) To investigate the influence of social, genetic, environmental, and domestic factors on the incidence of human disease and disability; (b) to see and promote measures, other than those usually employed in the practice of remedial medicine, for the protection of the individual and of the community against such forces as interfere with the full development and maintenance of man's mental and physical capacity; (c) if required by the University to do so, to make provision in the Institute for the instruction in social medicine of students and practitioners of medicine approved by the Board of the Faculty of Medicine in the University of Oxford.

The section of vital statistics, clinical department and radiographic department constitute the main departments at present and, separately or in combination, the staff has launched an ambitious programme. A large number of infants is enrolled for the purpose of follow-up and study on first attendance at the city's Child Welfare Centres. It is intended to examine these children clinically at three-monthly intervals and to record by x-ray skeletal development by means of standardized photographs at six-monthly intervals. In the first instance it is hoped to observe all these children for five years.

In co-operation with Morris Motors, Limited, an extensive study of occupational morbidity has been started.

After a first enquiry had given the necessary experience to establish a standard method of examination and records, an investigation has started on children aged 11-15 in several districts. It is intended to determine the relationship of thyroid enlargement to the iodine-content of the drinking-water.

The main work of the radiographic department is connected with the establishment of standards of normality of x-ray appearances of skeletal structure.

Forty-two pairs of twins are being observed, and their resemblances recorded. This is intended to be a pilot for wider studies.

A large-scale statistical enquiry on stillbirths and neonatal mortality is being made in relation to environmental and social factors. These, with other smaller investigations, give some idea of the vast scope of the programmes contemplated. The results will be anticipated most eagerly.

A. C. Stevenson

1033

## SOME LITERARY BY-PRODUCTS OF THE CHEMICAL INDUSTRY

There are some literary by-products of the chemical—and, more particularly, the pharmaceutical—industry which are so familiar that they need no description here. These are the circulars, pamphlets and booklets in which proprietary products are advertised to their potential users, sometimes by the provision of essential technical information that is not conveniently available elsewhere.

In a rather different category are the several periodicals published by pharmaceutical manufacturers. These are usually

not devoted exclusively to advocacy of the manufacturer's products, but their purpose is nevertheless the direct stimulation of interest in the goods manufactured.

Of recent years there have been some examples of the publication by the chemical industry of periodicals or other literature having no direct relation to the firm's products, except that they may include advertisements. Why does the chemical industry make itself responsible for such publications? Presumably they were started because it was thought that they would contribute to the general prestige of the firms responsible. It is probably impossible to prove whether they have this effect or not—or whether such an effect would be reflected in increased sales of the firm's products. But quite apart from the question of a utilitarian motive, there is no reason for supposing that industrialists are less susceptible than other publishers to the direct satisfaction that comes from publishing something that is good and valuable in itself.

There are now at least two periodicals—one British and the other Swiss—published by the chemical industry which are of high cultural value. The first of these is *Endeavour*, which is published quarterly by Imperial Chemical Industries, Ltd., and has now reached its sixth volume. It publishes articles by distinguished writers on a wide variety of scientific subjects, including the history and philosophy of science. A special feature of *Endeavour* is the attention given to its physical production. The typography and lay-out are arresting, without being meretricious, and the illustrations—especially those in colour—are often remarkably fine. In short, the high standard of the matter is fully matched by the technical standard of production, as befits a journal which treats science as an aspect of culture.

The second of these periodicals is the *Ciba Zeitschrift*, to which we have previously referred.<sup>2</sup>

This is a monthly (published less frequently since the war) journal devoted to the history of medical science, the medical profession, and related subjects. The first number appeared in September 1933, and in March 1946 the 100th number was published. This number contains more than the usual number of pages, and its subject—*Die Injektion*—is one of more than usual interest. Its author, Dr. H. Buess, devotes most of his space to a detailed and absorbing study—probably the best available account of this subject—of the history of intravenous injection, but he also discusses more briefly the origin of the use of the subcutaneous and intramuscular routes. Subsequent numbers have been on *Die Ueberwindung der galenischen Anatomie* (No. 101, May 1946), *Die Initiation* (No. 102, July 1946), *Gehör und Hören* (No. 103, October 1946) and *Die medizinische Fakultät von Paris* (No. 104, January 1947).

In 1942, a special number of the *Ciba Zeitschrift* was published in celebration of the 60th birthday of the president of the Ciba company—Dr. J. Brodbeck-Sandreuter (since deceased). This volume of 184 pages is devoted to various aspects—ethnological and historical; scientific and technical; legal—of drugs and their preparation, and all of the 31 articles are written by members of the company's staff. In the same year, a *Festschrift* to Dr. Brodbeck was also published. This clothbound volume of 449 pages was edited by Dr. Karl Reucker, editor of the *Ciba Zeitschrift*, and it is a satisfying example of the fine printing of Benno Schwabe of Basel. The introductory article by the Dean of the Medical Faculty at Basel, Dr. A. Werthemann, is followed by 10 interesting papers, of which we would select for special mention Dr. A. Schmid's contribution on the history of electrotherapy (pp. 73-121), a paper by Dr. H. Buess on the development of the doctrine of irritability (pp. 229-333) and Dr. Fritz Husner's catalogue (pp. 137-269) of the Basel medical theses from 1575-1829. The last includes author- and subject-indices and is a work of permanent bibliographical value. Other contributions are on medico-historical research in Switzerland (H. Karcher), the development of observations on electrical manifestations in animals and man (O. Merkelbach), and the early printing of medical works in Basel (A. Pfister). The numerous plates illustrating Dr. Pfister's article include some beautiful reproductions of the hand-coloured copy of the *Fabrica* in the library of Basel University.

Another *Festschrift* emanating from the chemical industry, but one of a different kind, is the Jubilee volume dedicated to Dr. E. C. Barell, president of the Hoffman-La-Roche company in Basel, on the completion of 50 years' association with the

<sup>1</sup> [For title, particulars and price, see *Book Reviews*.]

<sup>2</sup> [See *BMB* 794/17--Ed.]

company. This clothbound volume of 468 pages contains 34 papers written by members of the scientific staff of the Roche organizations in Basel, England, and the USA. About half the papers describe original work on vitamins, the other subjects including contributions on synthetic analgesics, drugs acting on the autonomic nervous system, and antibiotics. The volume is an impressive testimony to the scientific resources of the Roche organization, as was doubtless one of its intentions.

A peculiarly attractive smaller volume published by the Ciba company—*Schweizer Aerzte als Forscher Entdecker und Erfinder* [swiss doctors as researchers, discoverers and inventors]—was produced for an exhibition of books and manuscript illustrative of this theme. This is much more than a catalogue: it is a collection of miniature bio-bibliographies (accompanied in each case by a portrait) of 60 swiss doctors, starting with Vadian (1484-1551) and ending with Rorschach (1884-1922). Each subject occupies exactly two pages, and to secure this uniformity of plan must have demanded considerable ingenuity and much detailed work. On perusing this volume, one is struck by the great number of famous names in medicine that Switzerland has produced. Paracelsus, Conrad Gesner, Felix Platter, the Bauhins, Peyer, Brunner, Haller, Coindet, Koelliker, Goll, His, Forel, Kocher, Sahli, Bleuler, Yersin—these names are all a part of medical history.

The last volume to be mentioned here is the most remote from any apparent connexion with industry. It is a paper-covered anthology of french verses referring to the medical profession, published by Ciba in 1945 under the title *Vers et médecine*. The text is accompanied by numerous reproductions of the Daumier caricatures which first appeared in Fabre's *La Némésis médicale*. Many of the verses are satirical, and they range in period from the Middle Ages to the 19th century. The collection is an enchanting one, and a valuable antidote to professional self-satisfaction. Here is a description of "Le médecin des dames"—a type which is by no means extinct today. In fact, the third and fourth lines might be interpreted as referring to certain forms of psychotherapy in a sense far more literal than their author could have imagined:—

Sur papier rose ou de Chine  
Il met ses ordres du jour,  
Et parle de médecine,  
Comme l'on parle d'amour.  
Plus fin que ses camarades,  
Jamais il ne risque rien;  
Car il ne prend de malades  
Qu'autant qu'ils se portent bien.

The same writer, Eugène Scribe, satirizes the contemporary craze for treatment by acupuncture:—

Pour guérir, on vous pique;  
Système économique,  
Qui, depuis ce moment,  
Répond  
La joie en nos familles:  
Car nous avons en magasins,  
Plus de bonnes aiguilles  
Que de bons médecins.

Now, we think it absurd that patients should be treated by perforation with needles. Nevertheless, the same treatment, camouflaged and sanctified by pseudo-science still exists: but today the needles are hollow, and through them are squirted vaccines or glandular extracts of no demonstrable activity. Again, what are we to say of the 20th-century therapist who will, on some wishful and doctrinaire assumption, solemnly withdraw blood from the patient's vein and inject it into his buttocks?

The chemical industry has brought great gifts to therapeutics, but it is equally true that it has not been slow to capitalize the follies of medicine. The literary by-products which are the subject of these notes are, in their various ways, among the industry's more welcome contributions.

N.H.-J.

1034

## HEALTH OF LONDON

London County Council is by far the largest local authority in Britain so that the Report<sup>1</sup> of the County Medical Officer of Health and the School Medical Officer is always of much more than local interest. [Overseas readers should remember that London—County Council boundaries are not those of greater London—the mid-year population, 1945, of the County Area was 2,601,370.]

Mortality and morbidity figures departed from their prewar trends, though the incidence of most diseases related to social conditions is again back almost to prewar level. Intestinal infections have, however, increased in recent years. Two cases of smallpox and a case of typhus fever occurred, all contracted overseas, and there were no secondary cases.

Measles (23,518 notifications) was more prevalent than for many years and was by far the commonest infectious disease. The death-rate from measles was 0.012 per 1,000 of the population.

Maternal mortality was 1.93 per 1,000 live births compared with 1.84 for the rest of England and Wales, while the infant mortality-rate of 44 per 1,000 live births is the lowest ever recorded in London.

The large hospital service has been severely taxed by war conditions. Staff has been directed elsewhere, hospitals have been taken over, and so on; nevertheless, in addition to the usual work many thousands of military cases from the various battlefields were accommodated.

The outline of the scope of research work being carried on is of great interest in view of the fear of many medical men that they would be "regimented" in a big service.

In the section of the report on the school health service the most important change is, of course, the coming of the Education Act, 1944. Arrangements have already been made whereby all schoolchildren can have comprehensive free treatment in the Council hospitals or at voluntary hospitals.

The number of routine medical inspections of pupils is still less than half those made each year before the war, but the special provisions for handicapped pupils in which London has been so active have increased in spite of all difficulties.

This Annual Report is still much smaller than before the war, largely because comment on statistics and on the activities of the Health Department has been reduced.

A. C. Stevenson

1035

## AN IMPORTANT NEW ABSTRACTING SERVICE

There has long been a need for an abstracting journal to cover general medicine. This need is rendered more acute by the prodigious growth of medical periodical literature, which has, since the conclusion of the war, once again taken an upward curve.

Two new periodicals published by the British Medical Association—*Abstracts of World Medicine* and *Abstracts of World Surgery, Obstetrics and Gynaecology*—made their first appearance at the beginning of the present year and, judging from the early numbers, they will effectively perform the important task of providing an abstracting service in general medicine and surgery. Both journals are selective—they do not attempt to include every relevant paper published—and, considering the subject-range covered, readers may feel grateful that there has been no concession to the neurosis of comprehensiveness. So many "original" papers published in the world's medical press are the product of little but the desire to publish, that "comprehensiveness" would often imply the artificial prolongation of the life of that which were better never born. The adoption of a selective policy implies that, for every abstract published, many articles in different languages will have been scrutinized and rejected. There is therefore far more work involved in an abstracting service of this kind than is immediately evident to the reader.

We understand that over 1,000 periodicals are already passing regularly through the editorial offices of these journals, and they will ultimately amount to twice or three times the present number. These figures give some measure of the task that has been undertaken. They also indicate the value to the reader of such a service. Few men can hope to digest the contents of more than a very few journals in their original form, and few have the linguistic knowledge to read all journals of potential interest.

Perhaps it is the medical, surgical, and obstetrical specialists who will find these abstracting journals the most useful. But they will also be of great value to the worker in laboratory medicine who wishes to preserve contact with the broad and ever-widening stream of medical progress. In this connexion, it may be added that there is in the selection of material a commendable emphasis on experimental medicine. The general practitioner who has the time to read, and who attempts the increasingly

<sup>1</sup> [For title and particulars, see *Book Reviews*.]

difficult task of maintaining some awareness of what is happening in medical science, would find a subscription to *Abstracts of World Medicine* an excellent investment.

The abstracts are "informative", as opposed to "indicative". That is, each abstract is a précis of the original article, and contains the important quantitative data of the original. The publishers state that "No abstract can be regarded as a substitute for the article abstracted", but this is surely a rather unrealistic assertion. Libraries, university departments, and the few private individuals who subscribe to the special journals will still require the originals, and the effect, if any, of an abstracting journal on the circulation of the original periodicals is probably favourable. On the other hand, there is a vast number of readers of more general interests for whom the only feasible alternatives are to learn of the work reported in the original either at second-hand or not at all.

A few words may now be said on the background of this new abstracting service. It is fitting that the first appearance of the two new journals should coincide with the succession of Dr. Hugh Clegg to the editorship of the *British Medical Journal*, for it was Dr. Clegg who, while deputy-editor, saw the need for such a service and took the entire responsibility for its planning and execution. The service is conducted under the general direction of Dr. Clegg, with Dr. G. M. Findlay as editor. Dr. Findlay has had a distinguished career in medical research, and is the author of *Recent advances in chemotherapy*, of which a new edition is in preparation. This book was one of the best of the excellent *Recent advances* series. The assistant editor is Dr. S. S. B. Gilder, who numbers among his accomplishments an exceptional knowledge of modern languages, which was largely gained during years spent as a prisoner-of-war. The editorial staff also includes a well-known expert in medical bibliography—Mr. L. T. Morton—and several exponents of other special talents and qualifications.

Finally, a tribute must be paid to the British Medical Association for having had the enterprise and vision to sponsor this substantial and important contribution to medical literature.

N. H.-J.

1036

## MEDICINE AT THE CROSS-ROADS

There must be few, if any, branches of natural science that are so burdened with tradition as medicine. Our classification and nomenclature of disease, the divisions of medical practice, and the medical curriculum to which the student must submit, bear all too plainly the evidences of their origins in the obsolete past.

The student is burdened with the necessity of spending valuable time in the minute study of topographical anatomy for no better reason than that anatomy was, less than a century ago, almost the sole medical subject about which any positive knowledge was available. Medical specialization arose at a time when medical theory was still dominated by a solidist pathology, and the clinical specialities consequently have a predominantly topographical basis—the patient being arbitrarily divided into organs or regions, each of which is claimed as the province of a different kind of specialist. Although a high pitch of technical perfection has been reached in many of these clinical specialities, there is a growing awareness that most of the advances in medical knowledge are the product of studies which have little or no relation to the arbitrary divisions of medical practice.

Professor Neergaard is one of those who have asked themselves whither medicine is going, and whether it can even claim an existence as an independent discipline. In an essay<sup>1</sup> of 317 pages, he has much to say on some fundamental and fascinating problems of medicine. A superficial study of this essay does not reveal a closely-reasoned argument, and there is a great deal of repetition. The author would have done his readers a great service if he had included somewhere a concise statement of his argument and conclusions. He makes much of the alleged loss of faith in scientific medicine, and the rising influence of nature-cure medicine (*Naturheilmedizin*), but whatever may be the position in Switzerland, such cults could hardly be regarded as serious competitors to orthodox medicine in the English-speaking world.

Neergaard also points out that medical science is based on the classical physical conceptions which are now discredited by

modern physicists. While the "mechanistic" conceptions of modern medicine have led to great successes, the phenomenon of disease, he says, has its own peculiar laws and, in pursuit of these, medicine will evolve from an applied science to an independent scientific status—an autonomous medicine (*autonome Heilkunde*). This contention seems to involve a highly subjective attitude to "disease", by which it is promoted to the status of an independent "entity". "Disease" is a term applied to certain biological phenomena which human beings find inconvenient, and it is difficult to see why such phenomena, which involve a multiplicity of different biological situations and mechanisms, should be unified by obedience to distinctive biological "laws".

What exactly is meant by a "dynamic reaction-pathology" is not at all clear to the reviewer, although the author devotes 11 pages to explaining it. The term seems to be used throughout the book as a sort of slogan.

The chief interest of Neergaard's essay is in the train of speculations aroused in the reader by some of the questions posed. The conclusions are diffuse and difficult to grasp. What can be grasped seems to reflect more the personal convictions of the author than a well-grounded philosophy of medicine.

N. H.-J.

1037

## QUE SAIS-JE ?

### The present state of knowledge

In the course of recent months, we have received eight examples of an interesting series of books published by the *Presses Universitaires de France* under the collective title *Que sais-je?* The series is edited by Paul Angoulvent, and comprises a list of titles ranging over a remarkable variety of subjects: scientific, technical, historical, literary and artistic. These little books, which may perhaps be compared to the *Pelican* series in English, are designed to present brief readable surveys of the subjects concerned for the benefit of all intelligent readers, specialist or non-specialist. They are written by experts in a scholarly manner, without being encumbered with the wealth of detail contained in a textbook. Most of those we have seen include a historical survey and end with a summary of the present state of knowledge, future possibilities and general significance of the subject.

The format is handy, the type clear, and the general standard of production good. Those subjects that lend themselves to illustration are well supplied with diagrams, tables, graphs, sketches, etc. In the examples we have seen, no complete bibliographies are supplied, but in many cases there are short lists of books, or references are given in the form of footnotes.

The eight books with which we are concerned here fall roughly into three categories; five of them are to a greater or less degree physiological, one is on climatology, and the other two are concerned with evolution, genetics and heredity. No. 8 (*Le système nerveux et ses inconnues*, by Paul Chauchard, 1944) deals with the mechanism of nervous function. This is in some sense a companion volume to no. 181, by the same author (*Le moteur vivant*, 1945) which gives an account of the action of the muscles and their control by the nervous system. No. 188 (*La psychophysiologie humaine*, by Jean Delay, 1945) is again closely connected by its subject-matter with no. 8. No. 5 (*Comment se défend l'organisme*, by Léon Binet, 1943) describes the defence-mechanisms of the human body and how they react when confronted by cold, heat, pain, fear, asphyxia, haemorrhage, shock and burns, hunger and thirst, attacks on the respiratory system, and by food-poisoning. No. 194 (*Le sang*, by Louis van den Berghe, 1946) is an account of the blood: functions, composition, pathological variations, blood-groups and blood-transfusion. No. 171 (*Les climats et l'organisme humain*, by Emile Duhot, 1945) gives a description of the effects, both good and bad, that climate has on the human body. The two remaining volumes, no. 113 (*Génétique et hérédité*, by Maurice Caullery, 1943) and no. 141 (*L'origine des espèces*, by Emile Guyénot, 1944) supplement each other to some extent. The authors summarize the present position in their respective fields.

This series is to be warmly commended to the medical or scientific reader who wishes at the same time to improve his French and his knowledge.

A. H.-S.

<sup>1</sup> [For title and particulars see *Book Reviews*.]

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# SWISS ACADEMY OF MEDICAL SCIENCES

The Swiss Academy of Medical Sciences was founded at Basel on the 24 September 1943, to advance medical and biological science both in Switzerland and elsewhere. Its function is to act as a national council of research linking the medical centres of the country, all university faculties of medicine and the swiss medical profession. Its aims, based on the principle of free scientific research, are: to subsidize swiss scientific research both at home and abroad; to improve the knowledge of swiss scientists, to encourage by means of scientific gatherings, special commissions and other methods, the collaboration of swiss men of science; to establish relations with foreign scientists, especially swiss doctors working abroad; and to publish scientific works or finance their publication. The first number of the official organ of the Academy, *Bulletin der Schweizerischen Akademie der Medizinischen Wissenschaften*, appeared in February 1944, published by Benno Schwabe & Co., Basel, and we have now received the first volume. Volume I, no.1 contains an account of the foundation of the Academy, its statutes and of the *Bibliographica Medica Helvetica* (for review of this see *BMB*, 1946, 889). In volume I, no. 3, will be found the first Annual Report of the Academy for the year 1943-44, a highly satisfactory record of work projected and accomplished. Original articles appear in each number in german or french, each accompanied by summaries in german, french, italian and english. Like all the medical publications of Schwabe that we have seen, the technical standard of printing, paper and production is high.

H. A. I.

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# GENERAL MICROBIOLOGY

Another new specialist periodical which will fill a gap in british biological literature is the *Journal of general microbiology*, the first devoted exclusively to the study of microbiology to appear in Britain.

This new journal is conducted by the Society for General Microbiology, formed just over two years ago as a result of preliminary work done by a committee representing the various aspects of microbiology which met in 1943 under the chairmanship of the late Sir John Ledingham. This committee felt that the lack of contact between the various branches of microbiology impeded the development of the science as a whole, and decided to form a society which would provide a common meeting-ground for those working in the various specialist fields. At the inaugural meeting on 16 February 1945, at the London School of Hygiene and Tropical Medicine, it was decided that the Society should concern itself with the study of bacteria, viruses, micro-fungi, protozoa and microscopic algae in their various biological activities, and more particularly, the fundamental aspect of the study of these forms including their structure and development, physiology, nutrition, chemotherapy, systematics and ecology. The journal is edited by B. C. J. G. Knight and A. A. Miles; the associate editors are G. C. Ainsworth, W. B. Brierley, T. Gibson, A. T. R. Mattick, K. M. Smith, A. W. Stableforth, and D. D. Woods, and it will publish original research in the field covered by the Society's activities.

The *Journal of general microbiology* is published by the Cambridge University Press, Bentley House, 200 Euston Road, London, N.W.1, and for the time being there will be three numbers a year, the annual subscription being 50s. The contents of volume I, no. 1, January 1947, will be found listed in the *Guide to Journals* (*BMB* 1098) in this issue.

H. A. I.

1039

# A NEW ANAESTHESIA JOURNAL

The year 1946 witnessed not only the celebration of the centenary of the first operation under general anaesthesia in Britain, but appropriately the first issue of a new periodical devoted entirely to the study of anaesthesia. "... it has become obvious for some time," writes the editor, Dr. C. Langton Hewer, in the first number, October 1946, "that the rapid advance in all types of anaesthetic and analgesic technique requires fuller and quicker expression than can be provided in the over-loaded columns of the general medical press. . . . The full and accurate presentation of observations, theories, new methods, etc., is essential if a true advance is to be maintained and if unprofitable detours are to be avoided. Original contributions dealing with any aspects of the subject will be welcomed, the sole criterion for acceptance being their merit in the opinion of the Editorial Board, subject to space being available for reasonably quick publication. It is hoped that our colleagues abroad will also give us the benefit of their observations and views."

*Anaesthesia: Journal of the Association of the Anaesthetists of Great Britain and Ireland* will therefore be primarily a scientific periodical, but it will act also as the official organ of the Association. As it is to appear quarterly, it will be able to publish details of the Association's activities as well as news of general interest without undue delay. Book-reviews and abstracts from the current literature are also included. Volume I, no. 1, contains the history and activities of the Association summarized by its first President, Dr. H. W. Featherstone; an account of the early history of anaesthesia by the present President, Dr. A. D. Marston; and in addition to other original articles there is a reprint of the paper by Dr. John Beard on the anaesthetist and care of the surgical case, which originally appeared in the *British Medical Bulletin* celebrating the centenary of anaesthesia (*BMB* 826). Volume II, no. 1, January 1947, contains an account by Dr. Eunice M. Christensen of the history of cocaine from the earliest times up to the isolation of the pure alkaloid; and a discussion of cauda equina lesions following spinal analgesia by Dr. Tom Dinsdale.

*Anaesthesia* is attractively produced and is published for the Association by George Pulman & Sons Ltd., 24 Thayer Street, London, W.1. The price is 10s. per number. We are sure that this new periodical, which will assemble british contributions to the science and practice of anaesthesia, will be warmly welcomed by anaesthetists of all countries.

H. A. I.

1041

# RECENTI PROGRESSI IN MEDICINA

*Recenti progressi in medicina* is a new periodical, published in Rome by "Il Pensiero Scientifico", of which we have now received the first six numbers. As its title indicates, it consists of reviews, mostly borrowed from british and american sources, of recent progress in a particular field of medical science.

The editorial board is conscious of the need, especially among the younger elements in the italian medical profession, for keeping abreast with the advances in medical knowledge achieved during the years that Italy was cut off from the rest of the world. As Professor Bastianelli writes in his preface to volume I, no. 1, Ottobre 1946, "We wish to help all doctors who want to understand and to use the knowledge of today and tomorrow."—a task in which he is confident the periodical will have the assistance of the best elements in the medical profession throughout Italy. A warm tribute is paid to the collaboration of the British Council and of the medical section of American Relief for Italy, both of which provided not only assistance and advice but much selected material for translation. Recent numbers have dealt with the pneumonias, chemotherapy, meningitis and malaria. In addition to the review-articles surveying recent developments, sections are devoted to abstracts, laboratory methods, lists of the contents of important foreign medical periodicals, book-reviews and book-lists. We welcome this well-produced publication, and feel sure that it will go a long way towards bridging the gap in italian medical literature resulting from the war years.

H. A. I.

1042

# SOUTH AMERICAN MEDICAL PERIODICALS

One of the best-known and oldest-established of argentine medical periodicals is *La Semana Médica*, Buenos Aires. The number celebrating its jubilee, 1894-1944, has now reached us. It contains 796 pages and is divided into sections dealing with infectious diseases, social medicine, microbiology and parasitology, neurology and psychiatry, odontology, pediatrics, radiobiology and physiotherapy, therapeutics and pharmacology, and a miscellaneous section.

Of special interest are a historical survey by Dr. Gregorio Aráoz Alfaro of the growth of hygiene and public health services in Argentina from the time when she gained her independence from Spain, a study by Dr. Francisco de Veyga of the complex problem of the declining birth-rate among the white races, and an article on the historical aspect of paediatrics in Buenos Aires by Dr. Juan P. Garrahan. This article is followed by a biographical appreciation of the work done in pediatrics, both as practitioner and teacher, by Dr. Angel M. Centeno, who died in 1925, contributed by Professor Mamerto Acuña, himself an eminent contemporary pediatrician working in Argentina. The miscellaneous section contains an article in Portuguese by Professor A. Austregesilo on the advantages in mental training to be derived from a scientific education.

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We have received two other periodicals from Buenos Aires, the first of which, *Revista Oral de Ciencias Médicas*, is now in its 11th year of publication, but with this issue, no. 118, July 1946, it is to be considerably enlarged in order that it may better disseminate knowledge of recent advances in medicine. This number contains eight original articles, and the text of the address of welcome to Sir Howard Florey on the occasion of his installation as an honorary member of the Academia Nacional de Medicina. In addition, there is a section devoted to book-reviews and abstracts, and a further section, gives reports of medical meetings and congresses.

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*Archivos de la Secretaria de Salud Pública de la Nación*, Buenos Aires is, however, a new publication of which volume I, no. 1 appeared in December 1946. Its object is defined as the formation of an intellectual link between the medical profession and the medical auxiliary services. It is intended that the journal should concern itself especially with matters relating to social medicine, including public health, social services, hygiene, etc.

The first number of the journal contains the text of the address given by Dr. Ramón Carrillo on the occasion of his assuming the office of Secretary of Public Health in Argentina, and also the text of his discourses on the subject of decrees made in the interests of public health and on various aspects of social medicine. There are further articles on the forms of assistance available to the chronically unfit, and on anti-yellow-fever inoculation in Paraguay, and the journal also contains the text of the preamble and resolutions of the International Health Conference held in New York in June 1946.

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Another new south american medical periodical is the *Revista de Nutrición* published by the Instituto General de Salubridad, Lima, Peru, of which volume I, no. 1, July 1946, has recently been received. The journal will concern itself chiefly with the urgent dietetic and nutritional problems in Peru, but it will also include articles of wider scope as space permits.

This number contains articles dealing with the problem of the scarcity of animal protein in Peru, muscular output in relation to nutrition, the nutritional value of foods in relation to price, and an analysis of the composition and nutritional value of ices consumed in Lima during the summer of 1945.

V. E. C. M.

1043

## NOTES ON OTHER JOURNALS

In April of this year Sir Alexander Fleming paid a visit to Austria under the auspices of the British Council, and lectured in Vienna on 21 and 22 April. In anticipation of this event, the *Wiener klinische Wochenschrift* published on 18 April a *Festnummer* (volume 59, no. 15) dedicated to Sir Alexander Fleming. The number opens with a greeting to Sir Alexander by the editor, Professor L. Arzt. The remainder of the number consists of original articles on the following subjects: Bacteriological experiences with penicillin (Prof. H. Chiari); use of penicillin in surgery (Prof. L. Schonbauer); use of penicillin in internal medicine (Dr. E. Lauda); chemotherapy in laryngo-rhinology (Prof. C. Wiethé); the penicillin treatment of acute osteomyelitis (Dr. A. Winkelbauer); ophthalmological experiences with penicillin (Dr. K. Hruby); use of penicillin powder in Thiersch grafts (Dr. S. Tappeiner); and treatment of gonorrhoea with penicillin (Prof. L. Arzt, Dr. H. Gabriel, and Dr. W. Hofbauer).

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We have been pleased to receive volume I, no. 1, September 1946, of the *Medical Journal of Malaya*, which is the reappearance under a shorter title of the *Journal of the Malaya Branch of the British Medical Association*. This is the first number to appear since the Japanese occupation. As the majority of the Association's members had been cut off from all news of medical advances for four years, the opportunity has been taken in the first few numbers of the journal to reprint certain articles which have already appeared elsewhere. These contain for the most part summaries of recent advances in particular fields, and in this number six such articles have been reprinted from the *British Medical Bulletin*. The *Medical Journal of Malaya*, which is the official organ of the Malaya Branch of the British Medical Association, is edited by Professor G. V. Allen, the business manager and publisher is C. F. Young, Post Box 664, Singapore, and it is to appear quarterly.

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The aim of *International Medical Abstracts and Reviews*, a new periodical published monthly in Calcutta, is to make available to the Indian medical profession all worthwhile recent medical literature. To this end it is divided into sections consisting of reviews of medical progress, abstracts of current literature, current comments, laboratory and therapeutic notes, reports of societies, book-reviews and lists of the contents of the chief medical periodicals. This journal is more attractively produced and better printed than the majority of Indian medical periodicals that we have seen.

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We have received for the first time a copy of *Revista Ilyss* (Madrid), vol. 4, no. 7, December 1946, containing three articles dealing respectively with the acute intoxication caused by barbiturates, anaemia in pregnancy and vaccination against whooping cough. A book-review section is also included.

# Historical Notes

1044

## THE CAMBRIDGE MEDICAL SCHOOL

It is sad to think that the recently published book, *Some chapters in Cambridge medical history*<sup>1</sup>, is the last which will come from the pen of Sir Walter Langdon-Brown, who died on 3 October, 1946, a short time after its publication. The book is a reprint of six papers read to the section of the history of medicine of the Royal Society of Medicine and published in the *Proceedings* of that society at various times during the last ten years. In addition, a paper first published in *Nature* forms one chapter.

The book is written with the authority of one who received his education at Cambridge and who, more than forty years later, returned there to become Regius professor of physic. Langdon-Brown was proud of his association with a school of medicine which had produced such illustrious men as John Caius, William Gilbert, Harvey, Glisson, Heberden, Paget, Humphry, Foster and Allbutt. He writes of the work of these and many others who made so great a contribution to medicine and added so much to the reputation of the Cambridge Medical School.

In his first chapter, the writer deals with John Caius and his part in the revival of learning at Cambridge. There is a lucid account of Caius, who first introduced the study of practical anatomy into the British Isles, and who was the first to teach it. It is said that Caius was a man afraid of personal relationships and that his only intimate friend was Conrad Gesner, but he gave his heart to his college at Cambridge and to the Royal College of Physicians, of which he was president in 1555-60, 1562-63, and 1571. Caius wrote an original account of the sweating-sickness in 1552.

<sup>1</sup> [For title, particulars and price, see *Book Reviews*.]



The second chapter concerns William Gilbert, the physician and physicist and "the first of English modern scientists". Francis Glisson is the subject of the next chapter, in which the author also deals with what he calls (after Singer) the "insurgent century", the period from the defeat of the Spanish Armada to 1688, the dawn of the "age of reason". Glisson is well known for his treatise on rickets (1650), was Regius professor of physic at Cambridge from 1636-77, was one of the original members of the Royal Society, and was president of the Royal College of Physicians. He is eponymized in "Glisson's capsule", of which he gave an accurate description in 1654.

During the next century, the chair of physic was held from 1700-41 by Christopher Green, and from 1741-93 by Russell Plumtre, both distinguished only for the length of their respective tenures of the chair. During this period, however, Addenbrooke's Hospital was founded and certain laboratories were established. In 1724, William Heberden, who was to become the most famous figure in eighteenth-century Cambridge medicine, entered St. John's College. Heberden's first printed work, *Antitheriaca*, exposed the ridiculous polypharmacy existing at that time; he also undertook with Plumtre's father a revision of the *London Pharmacopoeia*, from which he succeeded in deleting many useless (and a few useful) drugs. It is strange, as the author remarks, that Heberden was never given the chair of physic at Cambridge. He had a most distinguished career and was a friend of numerous eminent contemporaries, among them Samuel Johnson and William Cowper. The rebirth of medicine at Cambridge, which might have followed Heberden's appointment to the professorship, waited until the next century and the coming of John Haviland, George Paget, George Humphry and Michael Foster. The disciples of the last three, "the great triumvirate", are almost contemporaries—J. N. Langley, W. H. Gaskell, W. H. R. Rivers, C. S. Myers, Dew-Smith, Gowland Hopkins, Charles Roy, Sims Woodhead and A. E. Shipley, to name but a few.

In his closing chapter the writer describes the transition from the nineteenth to the twentieth century and the coming of Clifford Allbutt. Langdon-Brown must have known Allbutt intimately; he devotes a good deal of space to biographical and other information about him, and perhaps rightly, for no one could more appropriately be chosen to close this fascinating little book than Allbutt, whom Osler affectionately called "my brother Regius". Like Allbutt, Langdon-Brown attained a high literary standard in his published work, well exemplified in the present publication. It will form a most valuable supplement to the *History of the Cambridge Medical School*, written by his contemporary at Cambridge, Sir Humphry Rolleston.

L. T. Morton

1045

### JONATHAN HUTCHINSON "The Only Generalized Specialist"

While in the earlier period of the history of the Society of Friends its members were debarred by their religious beliefs from entering the other learned professions, medicine seemed to be peculiarly congenial to Quaker doctrine and practice. Thus it happened that an unusually large proportion of Friends became physicians, and the tradition, once established, persisted. In the eighteenth century Fothergill and Lettsom, in the nineteenth Hodgkin and Lister, are honoured names in medical history. Jonathan Hutchinson, the subject of a new biography<sup>1</sup>, is fully worthy to take his place beside them. He was a general surgeon, an ophthalmologist, a neurologist, a dermatologist, a syphilologist and a leprologist, while as an observer of all kinds of rare manifestations of disease he had no equal. This versatility earned him from Professor Herkheimer of Frankfurt the description "a specialist in all medicine", and the same idea was expressed by Sir William Osler in the words "He is the only generalized specialist which the profession has produced". His main medical interest, however, was syphilis, and in the course of his practice he saw a vast number of patients suffering from this disease. "Hutchinson's triad", the syndrome of diffuse interstitial keratitis, labyrinthine disease and Hutchinson's teeth, seen in congenital syphilis, is known to every medical student. Well-known, too, is the hypothesis, which he held firmly to the end of his life, that leprosy is caused by the eating of decayed fish.

### SIR JONATHAN HUTCHINSON 1828-1913



Wellcome Historical Medical Museum

The author of this life, one of Hutchinson's sons, is not a medical man and, while giving due place to what was after all his father's main work, he has wisely refrained from going too deeply into it, in order to leave adequate space for other sides of his life, in particular the religious and the educational. While he remained all his life a faithful member of the Society of Friends and was of a deeply religious nature, Hutchinson was far from orthodox in his views. At the age of eighteen he was admonished by his father on the subject of dress with especial reference to a new and "unfriendly" hat, and he writes in his diary that day,

"having thought much, and I believe, seriously, on the subject, my deliberate conclusion is, that the peculiarities of Friends with regard to dress and language are a piece of the most absurd folly ever intermingled with the religious system of any Christian sect".

Nevertheless in his letters to his wife, selections from which form one of the most interesting parts of this book, he always uses the "thee" and "thou" in the ungrammatical, but typical, Quaker way. Darwin's theory of evolution exerted a profound influence on his religious thought and he came to abandon the belief both in a personal deity and in a personal celestial immortality.

Hutchinson was a great teacher, and this book does full justice to this side of his life. His interest in education is shown quite early by a passage in his diary written at the age of eighteen. Commenting on a lecture on ragged-schools in which the lecturer had recommended coeducation, young Hutchinson writes:

"I fully believe that the fair sex were intended as our companions and civilizers in childhood, as well as in more advanced life; that female companionship and sympathy are, in all ages and ranks, elevating to the character of the man."

In his advocacy of the state feeding of elementary-school children he was ahead of his time, for, in spite of the opposition of his friends, who were shocked at his "communism", he publicly recommended the provision of one good meal at least, provided out of school funds, for all children whom the state compelled to attend school.

Hutchinson was a great believer in visual aids to education, both medical and general. He founded educational museums at Haslemere and at Selby, and a clinical museum at Park Crescent, Regent's Park, later transferred to Chenies Street, off Gower Street. The Haslemere Museum remains to this day, but the medical collection was acquired after his death by the Johns

<sup>1</sup> [For title, particulars and price, see *Book Reviews*.]



Hopkins Medical School and was thus lost to England. At Haslemere and Selby, Hutchinson gave lectures nearly every week, over a period of some twenty years, on a great variety of subjects. Love of poetry played a great part in his life, among his favourites being Wordsworth, Cowper, the two Brownings and George Herbert.

The arrangement of the material in this biography leaves something to be desired. It is neither strictly chronological nor, as the chapter-headings suggest, altogether topical. The result is a little confusing and makes it difficult to get a complete picture of any particular aspect of Hutchinson's life without referring to a great many different places in the book, nor does the somewhat inadequate index offer as much help in this respect as it should. But it would be ungrateful to end on a note of criticism, and we would rather close with these words from Mr. Johnston Abraham's foreword:

"... this biography is ... important, and ... it is necessary it should be given to the world; for it presents a new and rounded picture of the man behind the world-famous figure; and it makes one understand why he should have asked to have carved on his tombstone the words:—

'A man of Hope and Forward-looking Mind.'"

Cyril C. Barnard

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### ANTONIO SCARPA 1752-1832

Reference to histories of medicine and biographical dictionaries reveals a wide divergence of opinion as to the date of birth of Antonio Scarpa. If the date so often quoted, 13 June, 1747, were correct, this year would be the bicentenary of his birth, but in this account of his life and work the opportunity must be taken to correct an error which has long been perpetuated. As long ago as 1832 Luigi Scarenzio gave Scarpa's date of birth as 19 May, 1752, and researches made by Favaro (1932) proved this to be correct. Capparoni (1932) has explained how the erroneous date of 1747 came to be accepted: a brother born in 1747, and who died before the subject of this note was born, had been baptized Antonio. The same christian name was bestowed on the boy born in 1752 at Motta, a village in austrian Italy.

### ANTONIO SCARPA 1752-1832



Wellcome Historical Medical Museum

Of poor parentage, Scarpa owed his education to an uncle, who instructed him in languages and mathematics, and sent him to the University of Padua, where he graduated Doctor of Medicine. Here he gained valuable experience while acting as secretary to Morgagni, whose failing eyesight made him depend on the young man, who dealt with his correspondence and read to him.

In 1772 his work brought him to the notice of the Duke of Modena, who appointed him to the chair of anatomy and theoretical medicine at the University of Modena, and erected a new institute for his researches. By the bounty of the Duke he spent the years 1780-81 in Paris and London, where he enjoyed the privilege of working with Percival Pott and the two Hunters. The year 1783 saw his translation to the University of Pavia, where, by the good offices of the Emperor Joseph II, he became professor of anatomy, occupying in addition the chair of surgery in 1787.

During the war between Austria and France, Scarpa was sent for by the Emperor Francis I, whose wife was suffering from a malignant disease. Under a flag of truce he crossed the Tyrol, then the seat of war, receiving a safe conduct over the frontier. The French proclamation of the Transpadane Republic in 1796 threatened Scarpa's career for, on his refusal to take the oath of allegiance, he was expelled from office. In 1805, however, Napoleon passed through Pavia on his way to Milan for his coronation as king of Italy. Received by the Faculty, he enquired for Scarpa, and on hearing the reason for his absence, ordered his immediate reinstatement, and conferred on him the grand cross of the Legion of Honour, together with a purse of 4,000 francs. Scarpa continued to hold the chair of surgery until 1812, and was rector of the Faculty until his death on 31 October, 1832. His connexion with the University thus extended from 1783 to 1832.

Endowed with a great capacity for work, he made good use of the scope which Pavia provided for anatomical research, and had a lucrative private practice. Scarpa's fascia, foramen, membrane, shoe and triangle are eponyms known to every medical student. Though he is rightly regarded as a great anatomist, his work covered a much wider field than is generally realized. His first work to win recognition was *De structura fenestrae rotundae auris et de tympano secundario anatomicae observationes*, Modena, 1772. (Sir Benjamin Ward Richardson was apparently unacquainted with this edition, for in his study of Scarpa he states that the book was published some time after 1789.)

In 1794 appeared his work on the nerves of the heart, *Tabulae neurologicae, ad illustrandam historiam anatomicam cardiacorum nervorum*, Ticini, which was highly praised for its correct delineation of the nerves and for the excellence of the anatomical plates. *Saggio di osservazioni e d'esperienze sulle principali malattie degli occhi*, Pavia, 1801, was translated into English in 1806. During his enforced "vacation" he had studied the subject of clubfoot, for which he designed a shoe which has served as a model for makers up to recent times. In addition, he had brought out the above-mentioned work on the eye, in which he contended that surgery of the eye was a part of general surgery. He was responsible for the revival of the old operation for cataract by depression, as opposed to extraction. Whilst operating for cataract on one occasion, the straight needle he was using, being poorly tempered, became bent, and, undeterred by this accident, he perceived the advantages of the curved instrument, which he used for all future operations of this nature.

Of Scarpa's works on hernia, the first, *Sull' ernie. Memorie anatomico-chirurgiche*, Milano, 1809, was popular for many years and often translated. As a supplement, he published *Sull' ernia del perineo*, Pavia, 1821, wherein he proved that hernia through the perineum was possible. This had often been questioned, but Scarpa, who had designed a truss for a patient with perineal hernia, had, on his death by other causes, conducted a post-mortem to verify his opinion.

Space forbids a description of all the works of Scarpa. It must suffice to say that his work on scirrhus and cancer (*Sullo scirro e sul cancro*, Pavia, 1825) embodies much that would command respect at the present day. In addition to the works mentioned, Scarpa contributed a number of books which have enriched medical literature: *Anatomicae disquisitiones de auditu et olfactu*, Ticini, 1789; *De penitentiari assium structura commentarius*, Lipsiae, 1799; *Sull' aneurisma, riflessioni ed osservazioni anatomico-chirurgiche*, Pavia, 1804; *Memoria sulla legatura delle principali arterie degli arti*, Pavia, 1817; *Saggio di osservazioni sul taglio rettovesicale per l'estrazione della pietra dalla vescica*

orinaria, Pavia, 1823; *Memoria sull' idrocele del cordone spermatico*, Pavia, 1823.

Held in high esteem by British scientific men, Scarpa was elected a Fellow of the Royal Society in 1791.

T. H. Bishop

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### CENTENARY OF THE DEATH OF G. M. BURROWS 1771-1846

The centenary of the death of an interesting figure in the history of general practice, and a leading authority on insanity in his day, fell on 29 October, 1946. Born in 1771 at Chalk, near Gravesend, George Man Burrows received his education at King's School, Canterbury, from which he was apprenticed, in his sixteenth year, to a surgeon-apothecary of Rochester named Richard Thompson. Dr. Burrows qualified at the College of Surgeons and the Society of Apothecaries after completing his medical education at Guy's and St. Thomas's Hospitals. After qualifying he became a general practitioner in London, and soon began to devote his energies to raising the status of the doctor engaged in general practice. He was instrumental in forming the Association of Surgeon-Apothecaries of England and Wales "to improve the education and render more respectable their own body" as a means to this end (Munk, 1878). For three years he acted as chairman of the Association and, largely as a result of its work, the Apothecaries Act<sup>1</sup> was passed in 1815. Its work accomplished, the Association dissolved, but not before it had voted 500 guineas to Dr. Burrows in recognition of his labours.

After the passing of the Act, a Court of Examiners was formed by the Society of Apothecaries, of which Dr. Burrows was a member until a dispute arose over the conduct of the Court of Assistants. He accordingly resigned early in 1817, and published a *Statement of circumstances connected with the Apothecaries Act and its administration*. But the first great task of his life was accomplished. As a result of the passing of the Act, adequate machinery had been established for testing the knowledge of candidates for general medical practice, and the status of the general practitioner had been raised accordingly. The qualification granted from Apothecaries Hall was to hold the field until the Royal Colleges instituted the conjoint examinations later in the century.

The second part of the life of G. M. Burrows began when he gave up general practice in 1816 and turned to the treatment of insanity. Commencing modestly with a small mental home at Chelsea, he opened a larger establishment, called the "Retreat", at Clapham in 1823. He obtained the diplomas of M.D. St. Andrews and L.R.C.P. London, in the following year, and was admitted a Fellow of the Royal College of Physicians in 1839. On 29 October, 1846, he died in his seventy-sixth year and was laid to rest in Highgate cemetery. These are the bare facts, but during this period of his life Dr. Burrows had become a leading practitioner in his speciality and written two books that had added to his reputation.

The literary activities of Dr. Burrows were considerable. He was one of the founders and editors of the *London Medical Repository*, which commenced publication in 1814 and quickly became established. It was in this journal that he published "Observations on the comparative mortality of Paris and

London", which was intended to dispel the impression overseas that the British were "most devoted to the practice of suicide". In the same year, 1815, he wrote "An account of two cases of death from eating mussels, with some general observations on fish-poison."

Impressed by the fact that "no detailed or even general report of the result of private practice in this malady [insanity] has ever been published by any British author" (Burrows, 1820), he decided to write his own *Commentaries*. Many years' delay in the appearance of this work caused the author to issue in advance *An inquiry into certain errors relative to insanity; and their consequences; physical, moral, and civil*, 1820, with the object of discounting certain popular errors of the time, e.g., that insanity was incurable. This book contains an interesting passage on private charity versus state enterprise:

"In the evolution of futurity, events are unfolded that justify a departure from established and approved customs. Hitherto it has been our glory and boast, that while, in foreign countries, every plan promotive of benevolence, science, or the arts, emanated from the government, and was always at the charge of the public; in the British empire those objects were accomplished by the spirit and liberality of the community. And when this feeling ceases to operate, the enviable superiority our institutions have attained, must decline, and no longer preserve their present general pre-eminence. If, however, a deviation from so exalted a principle be ever permitted, I conceive it may in respect to the civil regulation of lunatics."

The *Commentaries on the causes, forms, symptoms, and treatment, moral and medical, of insanity* was published in 1828, and was quickly recognized as the best work on its subject. Dr. Burrows was far-sighted enough to see that the treatment of insanity had an optimistic future. Even in these days when modern methods of treatment seem to be adding to the number of cures it may still be said: "The utmost success hitherto recorded falls short of that which is attainable" (Burrows, 1820).

F. Tubbs

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### JOHN ATKINS: AN EIGHTEENTH-CENTURY NAVAL SURGEON

Among the eighteenth-century naval surgeons who do not deserve to fall into oblivion may be numbered John Atkins. At a time when their importance was not generally recognized, he advocated cleanliness and fresh air in the prevention of disease. A competent observer, he embodied the results of his surgical experiences in a volume entitled the *Navy surgeon*, 1732. Born in 1685, Atkins entered the navy after completing his surgical apprenticeship (Moore, 1885) and was present at Sir George Rooke's naval engagement with the French on 13 August, 1704. It was a drawn fight, but casualties were heavy and Atkins was not without patients. There was Alexander Henderson who had his left eye struck out by a splinter, and Thomas Gibbs who received a large gunshot wound behind the neck. Gibbs lay for dead and would have been thrown overboard had not his gunmates perceived some small signs of life in him (Atkins, 1737).

In 1707 Atkins was aboard the *Tartar* stationed in the Channel. "We now and then", he says, "used to . . . make little southerly excursions, in hope of a prize; or to meet the Dutch vessels from Bourdeaux, who being our good friends and allies, we made to traffic with at pretty cheap rates."

On one of these occasions the *Tartar* narrowly escaped capture, only escaping under the cover of darkness. One of the crew, however, received a musket-shot through the thorax, and Atkins gives a detailed report of the case, observing that gun-shot wounds are "less dangerous, if they do not hit on large vessels, than wounds made by sharp instruments." (Atkins, 1737.)

Three years later Atkins was serving on the *Lion*. The fleet under the command of Sir John Norris lay in Vaia Bay near Genoa in March, 1710, when two enemy ships were sighted. The *Lion* in company with the *Severn* and the *Lime* gave chase. In the ensuing action forty men were wounded including the *Lion's* captain, Galfridus Walpole, whose right arm had to be amputated above the elbow. Atkins was called upon to amputate a number of shattered limbs, and in his account of his patients makes an observation that is of interest to all who have wondered

<sup>1</sup> [In the course of the 18th century, the apothecaries became recognized in England as general medical practitioners. The Apothecaries Act formally confirmed their status in this capacity.—Ed.]

how naval surgeons chose their time to operate in the pre-anaesthetic era. He writes:

"The heat and surprize in action makes it the properest time for amputating, men meeting their misfortune with greater strength and resolution, than when they have spent a night under thought and reflection."

In February, 1721, Atkins sailed for the Guinea Coast with the *Swallow* and the *Weymouth*, commissioned to suppress piracy off the west coast of Africa. The voyage was attended with some success, for two hundred and seventy pirates were captured at Cape Lopez with ten thousand pounds in gold-dust. But sickness proved a greater enemy than pirates. Three or four of the crew died every day for six weeks and Atkins had to act as purser for want of any other suitable survivor (Moore, 1885). After sailing to Brazil and the West Indies, where at Port Royal a hurricane carried off the masts, he returned to England in April, 1723.

Atkins was apparently ambitious. In his account of Captain Walpole's case he records that he suggested that

"two or three of our skillfullest surgeons" be called in consultation "not only as a duty to a gentleman of his [Walpole's] distinction, but a distant view, that the care and reputation which might accrue to me by their assistance in the cure might possibly place a man in one of the King's Yards".

But the shore appointment did not materialize. He was well read in the literature of his day, and perhaps had read in the *Dispensary*, by his contemporary, Dr. Samuel Garth,

"Who wants not merit needs not arm for fame;  
The dead I raise my chivalry proclaim  
Diseases baffled, and lost health restored  
In fame's bright list my victories record".

Atkins turned to the pen. In 1732 the *Navy surgeon* first appeared and was sufficiently popular to be reissued in an abridged form. His experiences in the tropics provided the material for *A Voyage to Guinea, Brazil and the West Indies* . . . 1735, in which he describes the slave trade. A curious little pamphlet entitled *Observations on the coast of Guiney* was issued as an appendix to the *Navy surgeon*. It deals with such subjects as the climate, the colour of the natives, and prevalent diseases. He advocates fresh air in sickrooms (cabins), and in extolling the virtues of cleanliness and good ventilation writes that the crew should

"have as free and frequent communication with the fresh air (by opening the ports) as may be consistent with safety and their other affairs, points too much overlooked and disregarded, though of the greatest consequence to preserve a ship's company on a voyage."

The last edition of the *Navy Surgeon* was published in 1742, but nothing more is known of Atkins's activities. He died in 1757 (Moore, 1885).

F. Tubbs

#### REFERENCES

- Atkins, J. (1737) *The navy surgeon: or, a practical system of surgery*, 2nd edit., London  
Moore, Sir N. (1885) *Dict. nat. Biog.* 2, 220

1049

### JOHN AND WILLIAM HUNTER

A new scholarly book<sup>1</sup> on John and William Hunter, by Miss Oppenheimer, contains two independent essays, of which the first is much the more important. It is a defence of Everard Home, who was John Hunter's assistant, brother-in-law and executor, for his rash destruction of Hunter's unpublished papers thirty years after Hunter's death. Miss Oppenheimer has studied Home's career in detail and her essay is precisely documented with notes and references and a bibliography of Home's numerous publications; it would be valuable for this careful detail alone. It is also an incentive to Hunter's admirers to compare his achievement with Home's and, in the light of Miss Oppenheimer's evidence, to decide whether Home deserves the obloquy which has pursued him since his burning of the books, or whether this was not made an occasion, as Miss Oppenheimer concludes, for spiteful denigration by William Clift, Hunter's last secretary and the conservator of his museum. Her conclusion is weakened by two misapprehensions. Firstly, she seems to accept Benjamin Brodie's remark that he had seen Hunter's papers at Home's house and that they were rough notes useless since Hunter's death. This opinion is more than doubtful in view of what was gleaned from Hunter's surviving papers by Clift and Richard Owen. Also it does not square with the supplementary

defence of Home that he had by 1823 published all that was of value in Hunter's notes, with due acknowledgement. Secondly, she misjudges Clift's character and underestimates his ability. Those who take the orthodox view will not be shaken by Miss Oppenheimer, but must study her evidence before maintaining their bad opinion of Home.

The essay on William Hunter, less important and not controversial, will appeal more readily to the general reader of medical history. It is based on a wide knowledge of the memoirs of the period, and brings out extremely well an aspect of Dr. William that has not been fully described before, his relations with patients and friends in the world of literature and politics. His hypersensitive quarrelsomeness, so unlike John's blunt forthrightness, appears markedly in this new sketch. It is strange to learn that he, who broke with his brother, kept a lasting friendship in spite of temporary differences with another prickly old bachelor, Horace Walpole.

W. R. L.

[At a generous estimate this book contains 40,000 words. It consists of two distinct essays, of a style and length suitable for publication in one of the journals devoted to medical history. The price of these essays bound as a book is such as to discourage most private purchasers.—Ed.]

## Book Reviews

The prices quoted are those which obtain within the United Kingdom

### ANAESTHESIA

#### 1050 Physics for the Anaesthetist

R. R. Macintosh & W. W. Mushin. Oxford, Blackwell Scientific Publications, Ltd., 1946. vii + 235 pages; 282 figures. 22 x 14 cm. £1 10s. [£1.5]

(i) Molecular movement: molecular weight: Avogadro's hypothesis: density: the Waller chloroform balance: Clover's chloroform apparatus; (ii) heat: specific heat; (iii) vaporization: latent heat of vaporization; (iv) laboratory experiments; (v) heat loss during anaesthesia; (vi) latent heat of crystallization; (vii) partial pressure; (viii) vapour pressure; (ix) atmospheric pressure: ether vapour pressure: respiration at high altitudes; (x) vapour and gas: nitrous oxide cylinder pressure: specific volume: Boyle's Law: isotherm: filling ratio: Charles' Law: Gay-Lussac's Law; (xi) flow of fluids through tubes: Poiseuille's Law; (xii) laminar and turbulent flow: resistance of anaesthetic apparatus; (xiii) flow of fluids through orifices; (xiv) flowmeters; (xv) the injector and its applications; (xvi) solution of gases: tension of a gas: oxygen therapy; (xvii) diffusion of gases and liquids: Fick's Law: osmosis: filtration: pulmonary oedema: respiratory obstruction; (xviii) development of anaesthetic apparatus: ether vaporizers: physical data: conversion factors. Biographical notes. Index.

This is a timely and useful book for which anaesthetists have increasingly been feeling the need. In it will be found the answer to many questions which the anaesthetist may ask himself, or may—sometimes to his embarrassment—have put to him.

The book's chief fault is over-simplification. The numerical data are given to two significant figures, so that the product of 28 and 63 is given as 1800 (p. 26), and the result of a simple calculation coming to 165 calories is given as 160 (p. 49). Figures for physical constants are frequently given for non-standard—and unstated—conditions; and some of the experiments are dangerously oversimplified. In an example showing how to correct the volume of a gas for change of temperature and pressure, the correction for pressure is wrongly applied (p. 109). Physics is an exact science, and a book on physics containing errors of this magnitude may fail to win the reader's confidence, and falls short of the standard of accuracy to which the modern anaesthetist should aspire. The authors "disclaim any pretence at being physicists", but this should not be used as an excuse for laxity, especially as the help of a physicist was available, and is freely acknowledged in the book.

<sup>1</sup> [For title, particulars and price, see *Book Reviews*.]

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The authors have, however, done a great service in bringing together a mass of most useful information. The sections on vapour-pressure (with a valuable composite graph), fluid-flow, and flowmeters are admirably clear; and some popular misconceptions, such as those on warmed gases, are convincingly exploded. The effect of the calibre of syringes, needles and endotracheal tubes on the passage of fluid through them is well brought out, and its practical application is emphasized. The phenomena of vaporization, and of specific heat and heat-transfer are well expounded; and partial and reduced pressure, diffusion, osmosis and filtration are clearly explained. There is an informative section on the filling of cylinders and the behaviour of their contents. At the end of the book is a comprehensive table of physical data. This provides much useful information which the scientific anaesthetist constantly needs, but has never before had conveniently provided. It is a pity that space could not have been found for a chapter on the ignition of anaesthetic gases and vapours. The book is well arranged and attractively produced; and Miss McLarty's illustrations and diagrams are so clear as to be self-explanatory.

governed by dynamics, not by statics". The "burning of food" in the body is explained by an account of the complicated oxidation- and reduction-processes by which the gradual release of energy from complex molecules is achieved. Professor Abderhalden does not confine his discussion to the animal world, but shows how, by the agency of plant and bacterial enzymes, inorganic molecules are made available for utilization by animals, so that the continuity of life is assured. "The whole tremendous process of the mutual relations between plants and animals is governed by enzymes". The development of each subject is traced with special emphasis on the fruitful co-operation between scientists of various disciplines, and the present trend of research is indicated together with its practical significance. Excellent photographs illustrate some methods of hormone and vitamin research. This stimulating book can be recommended not only to the interested general reader, but also to those engaged in research and teaching.

I. J. L.

- 1051 **A Short Handbook of Practical Anaesthetics**  
Höel Parry-Price. Bristol, John Wright & Sons Ltd., 1946  
127 pages; 50 figures. 19 x 12 cm. 12s. 6d. [£0.625]

(i) Introductory; (ii) instructions on anaesthetics for the nursing staff, (iii) general anaesthesia and some of its difficulties; (iv) gas-oxygen and gas-oxygen-ether; (v) cyclopropane, ether, and endotracheal anaesthesia; (vi) intravenous and local anaesthesia; (vii) anaesthetics for special operations; (viii) gases used for respiratory support and drugs for premedication; (ix) carbon dioxide absorption apparatus; (x) dangers, accidents, and complications of anaesthesia; (xi) falls of blood-pressure occurring during anaesthesia; (xii) the variations between service and civilian anaesthetics. Conclusion. Index.

This little book is clearly a wartime product. It is composed partly of material written for the information of naval sick-berth attendants, and much of it is written from the point of view of the anaesthetist in the armed forces. A wide range of good material is compressed into very small compass, so that the treatment is somewhat patchy. The style is conversational, wandering, and sometimes careless. It is illustrated with a few well-chosen anecdotes, which point their moral very tellingly.

Much is made of the need for asepsis in lumbar puncture, but nothing is said about wearing gloves. The author would have us believe that "absolute relaxation can be obtained by cautious whiffs of ether" added to gas-and-oxygen when the intestines are being handled; and that the use of an intratracheal tube prevents the introduction of septic material from the nose and throat into the lung. We are told that the patient should be carefully examined when he arrives in the anaesthetic room. This is clearly preferable to no examination, but most anaesthetists feel that a better place and time should be chosen for it. Published work is frequently mentioned, but in no instance is a proper reference given.

The nursing staff and the young anaesthetist will find much of value in the book, and particularly in the section on "anaesthetic tips", which contains a wealth of useful information. The reproduction and the paper are good, but 12s. 6d. seems an unduly high price for so slight a work.

- 1053 **Biology of Tissue Cells. Essays**  
Albert Fischer. Cambridge, University Press, 1946. 348  
pages; 55 figures. 24 x 16 cm. £1 11s. 6d. [£1.575]

(i) Units of living matter; (ii) tissue cells in vivo and in vitro; (iii) general morphology of tissue cells in vitro; (iv) special morphology of tissue cells in vitro; (v) rate of growth; (vi) tissue culture as a whole; (vii) regeneration; (viii) differentiation and organization; (ix) interchange of cells and medium; (x) substances; (xi) nitrogen metabolism of tissue cells; (xii) energy exchange of tissue cells cultivated in vitro; (xiii) concluding remarks and perspectives. Index.

This book on the biology of tissue cells is mainly concerned with specifically biological problems, such as cell-morphology, ecology, differentiation, and the concept of an organism. Penetrating into these are biochemical and biophysical discussions. The morphology, etc., makes fascinating reading; the biochemistry, if not far-reaching, is sound; the biophysics is not above reproach. In these respects Dr. Fischer has reflected the best that is available in these fields. For example, in Britain there are many teaching and research departments of biology with a fine and well-established tradition; departments of biochemistry are well-established but comparatively new; it is too early to predict how far-reaching will be the influence of biochemistry on biology as a whole; and as yet there is not a single teaching department of biophysics; biophysics is still in its infancy. The situation in other countries in general, and in Denmark in particular, is not dissimilar. A further hall-mark indicative of the hand of a distinguished research worker is that each chapter, perhaps each page, leads on to further points as in the established facts. This is in consequence an indispensable book for those interested in cells and in tissues.

Although it covers so wide a field, this book is not intended to be an exhaustive treatise on tissue culture. It is a series of essays on the general physiology and biology of tissue-culture cells, in their relation to organisms. The general problem of the relation of the cell to the organism is the main theme of the book. Much evidence is adduced to show that cells in tissue culture do not grow and behave as isolated individuals, but in a manner suggesting that an avian or mammalian tissue-culture is an organism, possibly of a very low order, but still an organism. For a culture cannot, as with protozoa, be grown from a single cell: there must be a number of cells in the original implant. Again, a culture shows marked differentiation of cells, according to their position in the culture, the nature of the environment, and the age of the metabolic products in which the cells find themselves. But it must be emphasized that the cells do not react to these gradients by migrating until all cells have the same environment. Instead, the culture reacts rather as an organism, reaching a size which is to a marked degree a fraction of the original implant, and, if injured, repairing the injured region rather than growing as a whole.

The final fifth of the book is devoted to the nutritional requirements of tissue-culture cells. In this difficult field relatively little advance is recorded; this part of the book is by far the least satisfying. One hopes that more attention will be given to this very important problem.

J. F. Danielli

## BIOLOGY

- 1052 **Spuren von Stoffen Entscheiden über unser Schicksal**  
Emil Abderhalden. 2. Auflage. Basel, Benno Schwabe & Co., 1946. 106 pages; 62 figures. Sw. fr. 6.

This short book is addressed mainly to the lay reader, yet accuracy is not sacrificed to popularity of presentation. The underlying theme, expressed in the title, is developed by a description of the nature and roles of hormones, vitamins, mineral salts, enzymes and antibodies. There is a clear account of the mode of working of the autonomic nervous system, and the mutual interaction of the endocrines and their role in the body. The intricate subjects of intermediate metabolism and intracellular processes are dealt with lucidly. The customary analogy of the cell to a chemical factory is rejected on the grounds that the very substance of each cell is in continual flux. "Metabolism is



1054 **Genetics for Medical Students**

E. B. Ford. London, Methuen & Co. Ltd., 1946. 163 pages; 10 figures. 18 x 12 cm. 7s. 6d. [£0.375]

(i) Mendelian heredity; (ii) the genetics of sex; (iii) mutation and the nature of heredity; (iv) the action of the genes; (v) polymorphism; (vi) methods of study in human genetics. Appendix. Bibliography. References. Index.

That a second edition of this book should appear so shortly after its initial publication is in itself, especially in these times, a testimony to its proven usefulness. For such a book as this there is undoubtedly great need, since an introduction to genetics is being offered in all medical schools both in undergraduate and postgraduate courses. It so happens that at the moment this book of Dr. Ford's is the only one which is available. It therefore must exert a very considerable influence upon the attitude of the members of the medical profession in general towards the subject of genetics.

The book had its origin in courses of lectures given by the author to medical students and it hence reveals the ideas of the author concerning the placing of emphasis among the different topics that are considered. There can be no hesitation in recommending this book as a textbook for such as are attending courses of instruction in human and clinical genetics. This edition differs from the first only in respect of a few minor changes and the addition of an appendix devoted to the Rhesus antigens. Since this story is as yet unfinished, it may be that Dr. Ford is wise in dealing with it in a somewhat superficial manner.

It so happens that those of us who have been teaching this subject have in recent years been recommending to our students that they should get one of two books, whichever happened to be available—this one by Dr. Ford, and Dr. J. A. Fraser Roberts' *Introduction to medical genetics*. They deal with the same subject, cover the same ground and are addressed to the very same group. The first has been used by some, the second by others, and it has been interesting and indeed helpful to collect the views of members of medical postgraduate classes concerning the relative usefulness of the two. It would seem that that of Dr. Fraser Roberts is strongly preferred. This is, from the point of view of production, a much better book, as it should be since it is far more expensive. Its print is most pleasing and its illustrations profuse. But it would seem that the main reasons for this preference are firstly the novel, and apparently very helpful, method of presentation of the subject-matter—a point worthy of careful consideration by all who write this kind of manual—and, secondly, the sense that the author was himself well experienced in clinical medicine. This derives, of course, from the placing of the emphasis by the author on purely clinical topics and clinical considerations.

The fact is that for certain categories of postgraduate students both books are necessary. One places the emphasis on clinical genetics and the other rather more upon population genetics. Amongst human geneticists there is some controversy concerning the wisdom of Dr. Ford in including in one of his appendices a classified list of some inherited characters in man. Since, as the author himself states, this list is not intended to be complete, it is very doubtful indeed whether it helps to provide a true measure of the importance of genetics in clinical and population medicine.

## CHILD AND HOME

1055 **The Problems of Family Life—An Environmental Study**

Agatha H. Bowley. Edinburgh, E. & S. Livingstone Ltd., 1946. 20 plates. vii + 99 pages. 18 x 13 cm. 5s. [£0.25]

(i) The elements of happy family life; (ii) the psychological needs of the family; (iii) parents and children in difficulties: teachers and children in difficulties; (iv) anxious parents and anxious children; (v) habit disorders at home; (vi) "naughty" children. Appendices. Bibliography. Index.

Miss Bowley has an enviable opportunity, springing from her experience as a general psychologist and educationalist, and a student of family life as seen in the mirror of a Child Guidance Clinic. This enables her to see the problems of the family as a whole, so that the factors of intelligence, personal emotional structure and environmental stress can be woven together for diagnosis and remedial adjustment. Dr. Bowley wisely does not delve into the dark and tangled undergrowth of the unconscious mind to account for the problem-family. For her very thesis is

an environmental study, an inspection of the interpersonal relationships of parents and children subject to common but accessible environmental stresses. She deals, for example, in the first place with the happy family of the average British home, its structure and its psychological needs. From that she naturally passes to considering the everyday problems, the unstable and neglectful parent, the rejected child, the broken home. She discusses the problems as they appear to the teacher and lays down simple and intelligible rules for the management of the nervous child. From the simple she passes to the more complex, considering defects of the anxious parent who can produce anxious children.

Some useful and simple statistics are given with regard to the distribution of such factors as intelligence-level, marital circumstances, psychological atmosphere, and her findings will be shared by all observers in this field.

1056 **The Nervous Child**

Hector Charles Cameron. Fifth Edition. Oxford University Press, 1946. viii + 252 pages; 8 plates. 19 x 13 cm. 10s. 6d. [£0.525]

(i) Doctors, mothers, and children; (ii) observations in the nursery; (iii) management and conduct; (iv) want of appetite and indigestion; (v) want of sleep; (vi) some other signs of nervousness; (vii) enuresis; (viii) toys, books, and amusements; (ix) nervousness in early infancy; (x) management in later childhood; (xi) nervousness in older children; (xii) nervousness and physique; (xiii) the underlying disturbances of metabolism in the nervous child; (xiv) the nervous child in sickness; (xv) nervous children and education on sexual matters; (xvi) the nervous child and school. Index.

Dr. Cameron's reputation is testified by a volume which has been held in esteem since 1919, and the fifth edition has little altered since then. This is not surprising in some respects, as the subject-matter concerns the behaviour and mental health of children, which have remained unchanged in the passage of years. The problems of child-behaviour spring from the basic emotional relationship of child and parent and, while economic changes and culture cloak and the vicissitudes of war and peace determine the surface-patterns of our conduct, the deep undertones are not subject to profound variations. Dr. Cameron is wise, therefore, in having left unchanged his description of the common problems of child-psychology.

The life of the nursery (where children are in the nursery), the common manifestation of nervousness, the developmental signs of growth, comprehension and emotional control cannot escape the acute observer of this or any generation. What really matters are the interpretations placed on conduct and the methods used in meeting and alleviating the distresses and obliquities of childhood. Furthermore, if we are to make a comprehensive study of the child in health and in phases of nervous disorder, we cannot confine our observation to the child of the well-to-do in its nursery with its trained—and perhaps overtrained—nurse, its not altogether accessible mother, and its unlimited dietetic advantages and its equally unlimited toys and cultural aids. The doctor is confronted with the child of working mothers with no nursery, no nurse, a tired husband and the bawdiness of a tenement or at best a prefabricated house. *Au fond* the problems are frequently the same, but the relationships are less complex and not obscured by the divided loyalties resulting from the presence of the nurse and the almost putative mother. To handle such problems of the elementary family needs perhaps less subtlety but more directness in the face of frequent economic and social obstacles.

Moreover, regarding interpretation, commonsense, which Dr. Cameron shows in kindly abundance, is enough to adjust many disorders of childhood, but the more recondite interpretations, which grow out of psychoanalytic theory and practice, cannot be lightly put aside. Granting the surprising emphasis which Freud places on sexuality, the instinctual life of the child viewed from an adult and not well-informed standpoint seems strange, but cannot be discounted, nor can the conflicts arising from total frustration of primitive needs be ignored. They certainly cannot be by those who observe uninhibited children at play when nurses' backs are turned and when doctors are not making their official visits.

With regard to the author's reference to the metabolic disorders, again we must refer him to the now-established trends of psychosomatic medicine. It is in childhood that we witness the foundation of metabolic troubles, and the child more than the adult is a body-mind in which emotion, growth and behaviour are inextricably interwoven. What may seem bizarre has become

commonplace to the psychiatrist who does not, as Dr. Cameron supposes, read Freud and then interpret to the child. In this respect Dr. Cameron's otherwise time-honoured book, full of wisdom in everyday observation and suggestion, is lacking in the modern insight which springs from a rational and objective child-psychiatry.

### 1057 The Care of Young Babies

John Gibbens. Second Edition. London, J. & A. Churchill Ltd., 1946. viii + 200 pages; 14 illustrations. 18 x 12 cm. 5s. [£0.25]

(i) Preparing for the baby; (ii) for husbands and fathers; (iii) clothes; (iv) the nursery; (v) growth and development; (vi) breast-feeding; (vii) difficulties in breast-feeding; (viii) artificial feeding; (ix) early mixed feeding; (x) feeding after the sixth month; (xi) nursery routine; (xii) the care of the skin and hair; (xiii) good muscles and sound limbs; (xiv) minor ailments; (xv) the care of twins and premature babies; (xvi) miscellaneous. Appendices. General index.

### 1058 Some Minor Ailments of Childhood—Being Hints to Mothers

Beryl Twyman. Edinburgh, E. & S. Livingstone Ltd., 1946. 32 pages. 18 x 12 cm. 9d. [£0.0375]

(i) Nursing and feeding sick children; (ii) independence in young children; (iii) frequent colds; (iv) poor appetite; (v) the nervous child; (vi) some hints on naughtiness and its prevention; (vii) bed-wetting and similar troubles; (viii) sleep problems.

Of books dealing with the care of infants and young children, there seems no end. That Dr. Gibbens' book, however, has met a need is shown by the fact that five reprints of the first edition have been necessary since 1940. The second edition has been thoroughly revised and deals comprehensively on more or less orthodox lines with all aspects of infant care. The opening chapters on preparing for the baby and for husbands and fathers are particularly good. In view of modern trends, particularly in the United States, one is glad to see the stress laid on the importance of breast-feeding and the clear advice given on how to overcome such difficulties as may arise.

Mothers of young children may be divided roughly into two classes—those who can read a book of this kind with profit and those who cannot. Dr. Gibbens has tried to cater for both classes, but, although he has succeeded admirably in meeting the needs of the more intelligent group, it is unlikely that mothers with a lesser degree of educational equipment would profit by its perusal even if they could afford to buy it. Indeed, it is doubtful whether any attempt to meet the needs of women of this type by means of a pamphlet is likely to succeed. Dr. Twyman has tried, but in doing so, she seems to have fallen, as it were, between two stools. In certain situations, however, it might prove useful as a supplement to individual teaching.

J. J. M.

### [1028] Report of the Care of Children Committee

Cmd. 6922. London, His Majesty's Stationery Office, 1946. 195 pages. 24 x 15 cm. 3s. [£0.15]

Introduction. Section I: Existing statutory provisions and administrative arrangements. Section II: How the children are cared for now. Section III: Conclusions and recommendations. Statistical tables.

[For review, see *BMB* 1028.]

## FORENSIC MEDICINE

### 1059 Forensic Medicine

Douglas J. A. Kerr. Fourth Edition. London, Adam & Charles Black, 1946. xii + 359 pages; 89 illustrations. 22 x 14 cm. 18s. [£0.9]

(i) Introduction—General Medical Council—professional secrecy; (ii) legal procedure in case of death; (iii) identification; (iv) changes after death; (v) death and sudden death; (vi) wounds and wounding; (vii) examination of blood and hairs; (viii) accident, suicide and murder; (ix) injuries to the head; (x) injuries to different parts of the body; (xi) burning, lightning and electric shock; (xii) gunshot wounds and identification of fire-arms; (xiii) heat, cold, starvation and neglect; (xiv) asphyxia; (xv) pregnancy, delivery, abortion; (xvi) infanticide; (xvii) sexual offences; (xviii) insanity and insane states; (xix) criminal responsibility and treatment of offenders; (xx) legal aspects of insanity; (xxi) toxicology; (xxii) mineral acids and alkalis; (xxiii) organic acids; (xxiv) metallic irritants; (xxv) irritants (cont.); (xxvi) animal and food poisoning; (xxvii) vegetable poisons; (xxviii) soporifics and anti-pyretics; (xxix) irrespirable gases; (xxx) miscellaneous poisons; (xxxi) civil actions. Appendix: The Poisons Rules, 1935. Index.

This well-known textbook of forensic medicine has now reached its fourth edition in some ten years, reflecting a popularity with both teacher and student which is well-deserved. It is short yet comprehensive, a model of clarity, well-reasoned, readable and reliable. The whole field of the legal, medical and toxicological aspects of the subject receives the able treatment of an author who is plainly widely-experienced in all departments and, except for a diversion on criminal responsibility, the space allotted is everywhere commensurate with the importance of the subject. The illustrations are arresting and chosen with judgement, though their relation to the text is a little haphazard owing to the greater frequency of photographs of wounds as compared with those of, say, new-born infants found in the lavatory-pan or of industrial stigmata. Good new writing has added to the attractions of the sections on blood-stains and their grouping, on the interpretation of blunt injuries to the head, and on many other smaller details. This edition also provides references for further reading at the ends of chapters. The principle is excellent but the selection has not the same merits throughout: whereas no less than ten references are given for further reading on blood, only one unimportant trifle is given for firearm-wounds and none at all for any one of the chapters in the section on toxicology—which should refer to much modern industrial work.

These are small criticisms of a book whose entire substance gives so little real cause for dissension. Douglas Kerr provides an outstanding example of clear teaching of elementary principles, a book eminently suitable for both the student and the practitioner.

Keith Simpson

## FREEZE-DRYING OF PROTEINS

### 1060 The Preservation of Proteins by Drying with Special Reference to the Production of Dried Human Serum and Plasma for Transfusion

R. I. N. Greaves. London, His Majesty's Stationery Office, 1946. (Medical Research Council Special Report Series No. 258.) v + 54 pages; 25 illustrations. 24 x 15 cm. 2s. [£0.1]

General introduction. (i) Methods of drying; (ii) the technical aspects of freeze-drying by condensation on mechanically refrigerated condensers; (iii) the development of the apparatus used by the M.R.C. Drying Unit and a report on the work done by the Unit. Summary. Acknowledgements. References.

This report, by an acknowledged expert, is intended for the general scientific reader and may be regarded as a valuable handbook of freeze-drying. It is explained in the introduction that commercial drying-processes lead to a degree of denaturation which is excessive for biological materials, although allowable in proteins that are to be cooked for food. Biological materials must, therefore, be treated by the process of vacuum freeze-drying, which leads to little or no protein denaturation but is unfortunately far too costly to be applied to less-valuable materials.

Part I of this report gives a brief survey of commercial drying-processes, and traces the development of the freeze-drying of biological materials from the early work of Shackell (1909) to the present day. The numerous modern methods of freeze-drying are outlined, and it is shown that the vacuum-manifold and chemical dessicant must be replaced by the vacuum-chamber and mechanically-refrigerated condenser, especially where large volumes in sterile-capped bottles are to be accommodated. A discussion on the desirable condenser-temperature is confused, particularly as the author makes the tacit assumption that the rate of vapour-transfer from product to condenser is directly proportional to the vapour-pressure difference between these surfaces. Part I concludes with an interesting speculation on spray-drying from the frozen-state, and it is to be hoped that this method will be the subject of future investigation.

Part II deals with the technical aspects of freeze-drying by condensation on mechanically-refrigerated condensers. It is shown that sera will dry well if held below  $-10^{\circ}\text{C}$ . in the early stages of drying, although certain samples of broth may require temperatures as low as  $-60^{\circ}\text{C}$ . The operating condenser-temperature must be chosen accordingly. In all freeze-drying techniques the methods of vacuum-maintenance and measurement are of paramount importance and the sections which deal with these matters, although familiar to many, will be of interest

to the general reader. A further section explains the details of heat-control and the manner in which heat-input must be balanced against rate of vapourization. Empirical equations are given showing the approximate relationships which exist between vapour-pressure difference, obstruction to vapour-flow, and heat-input. Certain arguments in this section are invalidated by the assumption that limiting-values may be given to the variables of an empirical equation. Notwithstanding this objection, these equations appear to be of value for correlation within the experimental range. Further sections deal with temperature-measurement, sterility, dry-weight determinations, the packing of dry material, and condenser-refrigeration. Part II is concluded by a section on the freezing of protein solutions prior to freeze-drying and a brief description of a new technique whereby ampoules and small bottles may be freeze-dried without preliminary freezing in a separate chamber.

The author's interest in freeze-drying originated in 1935 and resulted in the development, through two pilot plants, of a large drying unit which produced over 300,000 transfusion bottles of dried plasma and serum in the 2½ years of its operation from February 1943. The author, and his colleagues of the MRC Drying Unit, are to be congratulated on a fine achievement. These plants are described in part III of the text and illustrated by many photographs and diagrams which contribute to make this an interesting report of an important wartime project.

## GERIATRICS

### 1061 Medical Aspects of Growing Old

A. T. Todd. Bristol, John Wright & Sons Ltd., 1946. 164 pages; 13 figures. 22 x 14 cm. 15s. [£0.75]

(i) Introduction; (ii) the problem of old age; (iii) the mentality of the old; (iv) digestive processes; (v) digestive processes (cont.); (vi) digestive processes (cont.); (vii) on retirement; (viii) exercise and exercises; (ix) sleep; (x) constipation; (xi) the heart and circulatory system; (xii) blood-pressure; (xiii) emphysema; (xiv) care of the nose; (xv) care of the skin and hair; (xvi) care of the feet; (xvii) genito-urinary troubles in men; (xviii) genito-urinary troubles in women; (xix) conclusion. Appendices. Index.

Dr. Todd has written a small book, useful alike for the general practitioner and for the intelligent layman. He bases his thesis on the principle that the cultivation of health is more important than the treatment of disease; that whereas growing old is an inevitable process, yet many of the accepted signs of old age are really the manifestation of pathological changes which can either be prevented or rectified. Of the first importance Dr. Todd places a proper study of diet. He disclaims any validity for rigid uniformity in diet, and thereby honours the old adage that "one man's meat is another's poison". While everyone may not agree with all of Dr. Todd's theories of diet, a large number will be readily accepted, while his remarks on milk and on cooking will claim wide appreciation. The reasons for and his definition of a "fat-free" diet for the elderly are convincing and simple of practice.

On the questions of sleeplessness and constipation, Dr. Todd's clear-headed thinking should go a long way towards resolving many a neurotic approach to these subjects, and should be read by all who are worried by the problems of "inner cleanliness" with all its attendant horrors.

In an ageing population, Dr. Todd recognizes the need for keeping the elderly usefully and happily employed for as long as is possible. The theory of compulsory retirement at a given age has not only lost to the community a large number of persons whose work can ill be spared, but has led to a considerable amount of unhappiness and boredom among elderly people.

The description of simple exercises for the elderly, coupled with a number of simple hints on the attention necessary to the skin, hair and feet, completes a useful handbook for those interested in the care and management of old age. One hopes that this little work will be widely studied.

A.

<sup>1</sup> [A catchphrase used in advertisements for a proprietary saline purgative.—En.]

## HUMAN ECOLOGY IN THE MIDDLE EAST

### 1062 Middle East Science

A Survey of Subjects other than Agriculture. A Report to the Director General, Middle East Supply Centre, August, 1945

E. B. Worthington. London, His Majesty's Stationery Office, 1946. xiii + 239 pages; 16 plates; 5 maps. 25 x 16 cm. 7s. 6d. [£0.375]

Introduction. (i) Basic problems; (ii) surveys and the land; (iii) geology; (iv) meteorology; (v) rivers; (vi) underground water; (vii) domestic supply, water rights, and lessons from the past; (viii) plants and animals; (ix) forestry; (x) marine fisheries; (xi) inland fisheries; (xii) human diseases; (xiii) nutrition; (xiv) health and medical services; (xv) population and social studies; (xvi) review. References to literature. Appendix I. Appendix II. Index.

Those who have had the privilege of reading Dr. Worthington's *Science in Africa* will expect a high standard in this his later work on *Middle East science*, and they will not be disappointed. Furthermore, though he deals specifically with the Middle East, much of what he has to say will find a far wider application and many who are living and working in other countries will gain no little interest and instruction from this volume which might aptly be entitled "Demography, with illustrations from countries of the Middle East". It deals with climate, race, soil, nutrition, health and welfare; in short, the physical conditions and resources of these countries and "the interaction between man and his environment".

The area covered is extensive and includes Persia, Saudi Arabia, Sheikdoms of the Persian Gulf, Aden, Ethiopia, Eritrea, Somaliland, the Sudan, Cyrenaica, Tripolitania, Palestine, Lebanon, Syria, Iraq, Cyprus and Malta. It would be impossible in a single volume to deal with each of these separately, so the author has, wisely, arranged his report so as to treat of subjects and not districts and to illustrate his points by examples selected from any part of this wide area.

The first chapter, "Basic problems", forms an introduction to the author's method of approaching his great task. He shows how, in this area, are to be found all the stages of human development: first, hunters, as in the more remote parts of Ethiopia, Persia, Arabia and the Sudan; next, shepherds, as in the Arabian Peninsula, parts of Persia, Syria and the southern Sudan; thirdly, cultivators, in the valleys of the great rivers, the Euphrates and the Tigris, and in parts of Lebanon, Palestine and Transjordan; and, lastly, industrial workers, mostly in small rural industries and those engaged in the extraction of oil and minerals, and workers with wood and metal. He shows how, if progress is to take place, fundamental and technical knowledge must be translated into practice.

Dr. Worthington, by way of preliminary, demonstrates the environment and conditions of life of the inhabitants of the several countries, the geology, meteorology, climate and water-supplies, both superficial as from rivers and streams, and underground from wells and springs, and so passes on to irrigation and domestic storage. Next, the flora and fauna, the value, effects and uses of the forests among the former, and, among the latter, especially fisheries, fish-farming and culture, and by natural sequence to a consideration of the people themselves, their nutrition, their ailments and the modes of dealing with them and of the wider view of health services. A penultimate chapter, statistical in nature, tells of populations and population-trends and social studies, and the final chapter is of a review character, summing up aptly and succinctly all that has gone before. To construct and write an able epitome of so much detail must have been a difficult task and the author has succeeded admirably in putting the reader in possession of the main facts, enabling him to grasp the elements and the salient features of all the preceding chapters and thus, in the absence of a full index, directing him where he can find more detailed information on such subjects as most interest him, or on which he is seeking guidance.

None of this knowledge is superfluous if properly-adjusted and fruitful planning is to be achieved, and all ill-defined, haphazard planning is woeful waste; hence the importance of first trying out small-scale planning, of holding fast that which is good and then adopting these principles and adapting them for planning on a larger scale.

When we bear in mind that the area dealt with includes nearly a score of countries of widely differing characters—Independent States, Sheikdoms, Crown Colonies, Protectorates, Mandated Territories, and a Condominium—it will become obvious why they could not be all dealt with fully within the compass of a single volume, and the wisdom of the author's scheme is revealed.

The chapters (XII–XIV) devoted to health and disease are models of epitomized information. Something is said on each of the principal diseases and the problems they involve, without overstepping the line separating general interest and importance from minutiae which are the concern of the specialist. The author stresses the dependence of malaria, the most widespread of all the diseases, on agriculture; development of agriculture diminishing its prevalence and severity in some parts, while in others irrigation and flooding may lead to multiplication of breeding-sites for mosquitoes and thus to increase of malaria. Yellow fever is endemic in parts of the Sudan and due note is made of the danger of its being introduced by aeroplanes and travellers in them into countries where the insect vector abounds and the inhabitants are susceptible non-immunes. The measures taken to control the spread of sleeping sickness (trypanosomiasis) in the southern Sudan and their success are duly mentioned. Reference will be found even to *onchocerciasis*, though it has but recently been reported in the Sudan. It is a disease common in West and Central Africa and in Mexico and parts of Central America. *Schistosomiasis*, one of the modern plagues of Egypt, is dealt with fairly fully, as its ill-effects warrant. *Ankylostomiasis*, or hookworm disease, is also rife, though less than the last-named. The mode of infestation of man was originally discovered by Looss in Egypt in 1897. Typhus and relapsing fever, louse- and tick-borne, and enteric diseases, typhoid fever and dysentery, conveyed by water, food and flies, all receive attention, as do the important eye diseases, especially trachoma, and tuberculosis which is rife, and leprosy, which is less common.

Nutrition, considering its importance as a factor both of health and of disease, is disposed of in a few (7) pages in which a general account is given and also references to recent studies and research. A good résumé follows of health and medical services, including hospitals, health-centres, dispensaries, laboratories and research-facilities in the different countries and the training of doctors—there are nine medical schools—and of dentists, of subordinate staff, pharmacists, nurses, midwives, and sanitary inspectors.

Much study and personal observation have been put into the writing of this book. In the bibliography there are 200 references to books, articles, papers and pamphlets, and there is a list of 235 persons whom the author consulted personally for information. The work is embellished by 16 photographs, well reproduced, and all of interest; one longs for more such. There are two maps showing the countries with which the Middle East Supply Centre was concerned, one showing the physical features, the other the vegetational distribution. In addition, there are three line-maps embodied in the text, omitting all confusing and unnecessary detail, to illustrate the river-systems, the irrigated land and the swamp-areas.

One criticism we think should be made, because the defect can be remedied in a future issue, and that is the unsatisfactoriness of the index. Almost without exception the reference consists of a single word. Selecting one at random, we find Humidity, with 6 page-references, all of which might have to be read to find the information sought. How much more helpful would it be to use sub-titles, such as: Humidity and air-conditioning, H. and climate, H., effects of, on health, on insect development, on mental and physical activity; H., measurement of; H., natural and water supplies; H., variability of in the Sudan, and so on, for all these points are mentioned in the text. Apart from this, the whole is excellent; misprints are very few, the print is clear and the binding adequate, and general format pleasing. The work deserves to be widely read.

H. Harold Scott

## MEDICAL HISTORY AND PHILOSOPHY

### [1036] Dynamische Reaktionspathologie

Die Überwindung der medizinischen Grundlagenkrise durch die moderne Physik und Biologie

### Entwicklung und Ziele einer eigengesetzlichen Medizin und ihre Auswirkung in Forschung, Praxis und Gesundheitspflege

K. v. Neergaard. Basel, Benno Schwabe & Co., 1946. 317 pages. 24 x 17 cm. Sw. fr. 24

(A) Problematik der heutigen Medizin; (B) Wandlung des naturwissenschaftlichen Fundamentes; (i) Grundbegriffe und Denkformen der klassischen Physik als Fundament der heutigen Medizin; (ii) Grundbegriffe und Denkformen der modernen Naturwissenschaft als Fundament der zukünftigen Medizin; (C) Entwicklung einer dynamischen Reaktionspathologie; (i) Die praktische Auswertung der klassischen und modernen Physik; (ii) Umbau der wissenschaftstheoretischen Struktur der Medizin unter dem Einfluss der modernen Physik und Biologie; (D) Organisatorische Auswirkungen; (i) Von der Individual- zur soziologischen Medizin; (ii) Hausarzt-Spezialarzt; (iii) Überwindung der Nachteile des Spezialistentums; (iv) Unterricht; (v) Forschung; (vi) Organisation der Gesundheitspflege; Gesundheitspolitik, Gesundheitswirtschaft und ihre Beziehung zur Sozialversicherung. Schluss, Literatur.

[For review, see BMB 1036.]

### [1044] Some Chapters in Cambridge Medical History

Sir Walter Langdon-Brown. Cambridge University Press, 1946. viii + 119 pages; 19 x 13 cm. 6s. [£0.3]

(i) John Caius and the revival of learning; (ii) William Gilbert and the dawn of experiment; (iii) Francis Glisson and the insurgent century; (iv) William Heberden and the age of reason; (v) John Haviland and the beginning of reform; (vi) the great triumvirate and the rise of the medical school; (vii) Clifford Allbutt and the transition from the nineteenth century. References.

[For review, see BMB 1044.]

### [1045] The Life and Letters of Jonathan Hutchinson

Herbert Hutchinson. London, William Heinemann (Medical Books) Ltd., 1946. viii + 257 pages; 12 plates. 22 x 14 cm. 12s. 6d. [£0.625]

(i) Early family history; (ii) the apprenticeship; (iii) the first years in London; (iv) Jane Pynsent Hutchinson; (v) early married life (at Finsbury Circus); (vi) letters, 1866–71; (vii) the New Sydenham Society; (viii) the London hospitals and medical teaching; (ix) medical work 1859; (x) antiseptic surgery and anaesthetics; (xi) the medical societies; (xii) a holiday chapter, Germany and Denmark; (xiii) Cavendish Square; (xiv) Haslemere; (xv) letters, 1878; (xvi) letters, 1879–80; (xvii) letters, 1881–2; (xviii) letters, 1883–4; (xix) letters, 1885–7; (xx) educational work, Haslemere and Selby; (xxi) medical work, 1890–1900; (xxii) leprosy; (xxiii) a synopsis; (xxiv) the last years. Index.

[For review, see BMB 1045.]

### [1049] New Aspects of John and William Hunter

Jane M. Oppenheimer. London, Wm. Heinemann (Medical Books), Ltd., 1946. xviii + 188 pages; 5 illustrations. 21 x 13 cm. £1 5s. [£1.25]

Part I: Everard Home and the destruction of the John Hunter manuscripts. (i) Introduction; (ii) Everard Home during Hunter's lifetime; (iii) Everard Home after Hunter's death; (iv) The holocaust; (v) Everard's defense. Notes for Part I. Bibliography. Appendix: Everard Home's publications. Part II: William Hunter and his contemporaries. (i) Introduction; (ii) William Hunter's entrance into the world of affairs; (iii) William Hunter and David Hume; (iv) William Hunter's political vacillations; (v) William's motives. Notes for Part II. Bibliography. Index.

[For review, see BMB 1049.]

## MEDICAL MICROBIOLOGY

### 1063 The Cultivation of Viruses and Rickettsiae in the Chick Embryo

W. I. B. Beveridge & F. M. Burnet. London, His Majesty's Stationery Office, 1946. (Medical Research Council Special Report Series No. 256). viii + 92 pages; 10 illustrations. 24 x 15 cm. 2s. [£0.1]

(i) Introduction; (ii) techniques of inoculation and lesions produced; (iii) focal lesions on the chorioallantois; (iv) factors influencing susceptibility of the chick embryo to minimal amounts of virus; (v) the cultivation of individual viruses and rickettsiae; (vi) cultivation of bacteria, protozoa and foreign tissues in chick embryos; (vii) references.

In 1936 Dr. F. M. Burnet of Melbourne wrote one of the Medical Research Council's well-known "green reports" on *The use of the developing egg in virus research*. This described the technique, then quite a new one, of inoculation of viruses on to the chorio-allantoic membranes of developing chick-embryos. Eighteen viruses or related organisms had by then been studied in this way; the report ran to 58 pages with a page-and-a-half of references.



During the past decade the subject has grown enormously, and egg-inoculation has become the most important tool of current virus-research. Beveridge & Burnet's new report—though based upon the older one—covers a vastly wider field. It covers 92 pages (rather more closely spaced, now) with twelve-and-a-half pages of references; and the behaviour of 60 viruses in the egg is now described. The most important change is that infection of the chorio-allantoic membranes is now only one of many techniques which are available. True, it is still the most generally used. For primary isolation of some viruses, however, such as influenza and mumps, it is better to use inoculation into the amniotic sac. For growing rickettsiae and some viruses, inoculation into the yolk-sac is the method of choice. To obtain big yields of influenzal and related viruses for making vaccines, simple injection into the allantoic cavity is best. For other purposes the research worker may inject intravenously, into the extra-embryonic body-cavity, the albumen sac, or into the body of the embryo itself. There are various indications as to which of these methods is best for any purpose. Embryos of different ages are needed in different circumstances. Different temperatures of incubation may be required. To all these problems the authors offer a sure guide, and warnings are given as to the non-specific lesions which may lead the unwary astray.

The full account of the work carried out on 60 viruses is full of encouragement. Only 10 of these showed no signs of growing at all, 6 gave doubtful results, while 44 probably multiplied. (For a few of these 44, confirmatory evidence is still awaited.) This means that anyone tackling a "new" virus by techniques involving fertile eggs may entertain strong hopes that one or other will be of service to him. Even since the report went to press, a new triumph has been announced—the production by Shope and his colleagues of a vaccine against rinderpest, the virus having been suitably attenuated by growth in eggs.

C. H. Andrewes

## 1064 Virus as Organism

### Evolutionary and Ecological Aspects of some Human Virus Diseases

Frank MacFarlane Burnet. Cambridge, Mass., Harvard University Press, 1946. 134 pages. 22 x 14 cm. 11s. 6d. [£0.575]

(i) Reproduction, variation, and survival; (ii) evolution and change in virus disease; (iii) the reaction of the host to virus infection; (iv) herpes simplex; (v) poliomyelitis; (vi) psittacosis and related infections; (vii) smallpox, alastrim, and vaccinia; (viii) yellow fever; (ix) influenza; (x) conclusion. Bibliography.

In this book, an expansion of his Dunham lectures given at Harvard in 1944, Dr. Burnet has developed part of the theme of his earlier work, *Biological aspects of infectious disease*, Cambridge, 1940. In that most stimulating volume, he treated his subject from the point of view of a biologist writing for biologists—including medical and other biological students. In *Virus as organism* he confines himself to virus diseases of man, and writes this time rather for medical men; but the theme is still the relation of parasite to host, and their inter-related evolutionary development. The history of infectious disease, so far as we know it, is of a surging tide of battle, of the waning of one plague and the waxing of another. Doctors, and especially those concerned with public health, will do well to read this book, to consider how the facts related apply to their own problems, and then to read it again, and perhaps again. The earlier chapters discuss in a general manner "reproduction, variation and survival", "evolution and change in virus disease" and "the reaction of the host". Then the author discusses his generalizations as they apply to herpes simplex, poliomyelitis, psittacosis, smallpox, yellow fever and influenza—diseases, the behaviour of which affords instructive contrasts.

The author suggests that in prehistoric man, living in quite small communities, there would be no opportunity for the occurrence of epidemic disease as we know it today. Only in the case of herpes will he allow that the man-virus association may be very ancient: for the other diseases he treats of, he looks for an origin within comparatively recent years—or at most centuries—from some virus-infection of other animal-species. In the case of poliomyelitis he refers to the related rodent-diseases, in psittacosis obviously to birds, in smallpox to domestic ungulates, in yellow fever to monkeys, in influenza, rather more hesitantly, to pigs. The thesis is a stimulating one, even though it may not

always carry conviction. We should often do well to try, as he suggests, to understand infection by means of a "dynamic interpretation based on the changing requirements for survival of a virus whose environment is being altered by its host species' changing habits."

C. H. Andrewes

## 1065 A Text-Book of Bacteriology

R. W. Fairbrother. Fifth Edition. London, William Heinemann (Medical Books) Ltd., 1946. viii + 480 pages; 20 illustrations. 22 x 14 cm. 17s. 6d. [£0.875]

Part I: General bacteriology. (i) Historical survey; (ii) the morphology of bacteria; (iii) the biology of bacteria; (iv) the cultivation of bacteria; (v) the multiplication of bacteria; (vi) the destruction of bacteria; (vii) chemotherapy; (viii) infection; (ix) immunity; (x) antigens, antibodies and their reactions; (xi) hypersensitiveness: anaphylaxis, idiosyncrasy and allergy; (xii) the classification of bacteria; (xiii) bacteriology and medicine. Part II: Systematic bacteriology. (xiv) *Staphylococcus*, *micrococcus* and *sarcina*; (xv) *streptococcus*; (xvi) *pneumococcus*; *pneumonia*; (xvii) *neisseria*; *gonorrhoea*; *meningitis*; (xviii) organisms of the coli-typhoid-dysentery group: *genus bacterium*; (xix) the *Friedlander* group and *genus proteus*; (xx) *pasteurella*; *plague*; (xxi) *brucella*; *undulant fever*; *tularaemia*; (xxii) *haemophilus* and associated organisms: *whooping-cough*; (xxiii) *corynebacterium*; *diphtheria*; (xxiv) *mycobacterium*: *tuberculosis*; *leprosy*; (xxv) *vibrio*: *cholera*; *spirillum*; (xxvi) *pfeifferella*; *glanders*; *meliodosis*; (xxvii) *actinomyces*: *actinomycosis*; *madura disease*; (xxviii) *bacillus*: *anthrax*; (xxix) *clostridium*: *tetanus*; *gas gangrene*; *botulism*; (xxx) miscellaneous genera: *pseudomonas*; *lactobacillus*; *fusiformis*; (xxxi) *spirchaetes*: *syphilis*; *yaws*; *Well's disease*; *seven-day fever*; *relapsing fever*; *Vincent's angina*; (xxxii) filterable viruses; (xxxiii) the rickettsiae; (xxxiv) bacteriophage; (xxxv) *viruses of water, milk and shell-fish*. Part III: General technique. (xxxvi) *staining methods*; (xxxvii) *preparation of culture media*; (xxxviii) *technique*. Index.

If reprints are included, this is the eleventh appearance of this book in less than ten years. No other tribute to its well-deserved popularity could be more eloquent than this fact. The medical student in Britain is expected to know enough of the technique of bacteriology to be able to perform simple examinations himself, but a great deal more about the theory of the subject, because this is fundamental to the understanding of infection as seen in the clinical field. He must know enough about diagnostic laboratory-tests to be able to interpret their results with a proper degree of reliance or scepticism, and perhaps rather more about immunology, because he should not only be proficient in common methods of artificial immunization, but capable of justifying their use to the sceptic. The book he needs must therefore be a nice blend of sound theory with not too much technique: the latter he should gain mainly from his practical classes. It should be readable and well-informed, and neither too long and detailed nor over-simplified. This is precisely the ideal which Fairbrother's textbook has attained. It is strictly a textbook of bacteriology—including, of course, filterable viruses: the mistake is not made of including rather inadequate accounts of protozoa or helminths, and apart from an account of actinomycosis, mycology is omitted.

A highly significant innovation is the mention of the control of chemotherapy, along with diagnosis and specific therapy, as one of the main functions of bacteriology in medicine. The sulphonamides and antibiotics have indeed made the clinician more dependent on the laboratory and more alive to the services which it can render him. References to the chemotherapy of various infections are some of the new features in this edition: it evidently went to press too soon for anything to be said about the efficacy of streptomycin in both tularaemia and plague. Streptomycin is mentioned in connexion with tuberculosis, and it is also said that "The sulphonamides, in particular promanide, and penicillin have also given disappointing results". It is perhaps a little unfortunate to bracket these two treatments, because the sulphones have a very striking effect at least on experimental tuberculosis, whereas penicillin so obviously can have none that there are in fact no results at all, no one having ever deliberately studied so unpromising a form of treatment. The section on actinomycosis, although quoting Erikson's work showing that bovine and human strains of *Actinomyces* differ, still takes the view that the human disease is attributable to infection from an animal source. The more-commonly accepted present view is that the infection is autogenous. It is possible to offer only a few minor criticisms of this book, usually on matters of opinion rather than fact, and teachers may commend it to their students with confidence that it will nowhere lead them astray.

L. P. Garrod

## MEDICAL POLITICS

### 1066 Now for Health

The What, Why and How of the National Health Service

D. Stark Murray & L. C. J. McNae. London, St. Botolph Publishing Co., Ltd., 1946. 78 pages. 22 x 14 cm. 4s. 6d. [£0.225]

(i) The past; (ii) the Health Bill; (iii) hospitals; (iv) the family doctor service; (v) the place of the local authority; (vi) the specialist and ancillary services; (vii) the opposition; (viii) the Health Centre; (ix) the citizen and the Health Centre; (x) democracy in the Health Service; (xi) education; (xii) farther yet. Appendix.

This booklet by Dr. D. Stark Murray and L. C. J. McNae expresses the opinions of the Labour Party on the future of the embryo which it has just conceived. The views are frankly prejudiced and indeed it would be strange if they were not, for Socialists have achieved as a result of hard work and much thought over many years the authority to carry into practice a plan which embodies with very minor exceptions all their doctrine. If, in their triumph, they are a little impatient of objections and tend to mention only a few of them purely in order to knock them down, that also is understandable.

The facts brought forward to support the case are well-marshalled and from unimpeachable sources. The unsatisfactory distribution of medical services of all kinds throughout the country, the heavy incidence of preventable disease in the lower economic group of the population, the very real difficulties of the mother and her children when sickness attacks them, the shortage of hospital beds and so on, are stated in such a way that no one could reasonably doubt their accuracy or importance.

Scattered throughout the text are a series of telling quotations from speeches of Labour members in support of the Bill in the House of Commons which indicate very clearly that the speakers were far from unaware of the problems of the proposed service. The authors, too, one of whom is a medical man, have a very sound knowledge of the doctors' difficulties, and their remarks on the profession are shrewdly calculated to suggest to the doctor that the new service is in his own interest, while so avoiding criticism as neither to antagonize him nor to make him lose face with a lay reader.

In outline the book is arranged in this manner. After a preliminary justification of the need for it, the Act is outlined. The important sections dealing with hospital services, general-practitioner service, the work of the local authorities and the health-centres are then justified separately, explained and the likely benefits described. A chapter on "The Opposition" dealing with the British Medical Association's views makes great play with the parallelism between the attitude of the British Medical Association to the introduction of national health insurance in 1911, and their present opposition.

This booklet, then, represents the case for the national health service of the present Government. As such it is a sound presentation, accurate and moderate in tone throughout.

A. C. Stevenson

## MEN UNDER STRESS

### 1067 Men under Stress

Roy R. Grinker & John P. Spiegel. Second Edition. London, J. & A. Churchill Ltd., 1945. xii + 484 pages. 24 x 15 cm. £1 5s. [£1.25]

I. The men. (i) The men: their background and selection. II. The environment of combat. (ii) The combat units; (iii) motivation for combat-morale. III. The reactions to combat-morale. (iv) Reactions to combat, based on previous emotional disorders; (v) the neurotic reactions to severe combat stress; (vi) psychodynamics; (vii) treatment and results. IV. The reactions after combat. (viii) The return home; (ix) the syndrome of "operational fatigue" (war neuroses) in returnees; (x) passive-dependent states; (xi) psychosomatic states; (xii) guilt and depression; (xiii) aggressive and hostile reactions; (xiv) psychotic-like states; (xv) psychodynamics; (xvi) treatment: psychotherapy; (xvii) treatment: narcosisynthesis; (xviii) treatment: adjunctive; and results. V. Civilian applications. (ix) Applications to civilian psychiatry; (xx) general social implications. References. Index.

The authors emphasize in their introduction that the neurotic reactions of aircrew, with which this book deals, are essentially the same as those of "Everyman in his struggle to master his own environment": consequently they believe that the lessons learnt from the cases they studied are applicable to the adaptations, and to the failures in adaptation, of normal citizens exposed to peacetime stresses.

A brief survey of the air-force personnel and a section on the structure, tensions and motives of combat units, lead up to a well-documented account of the immediate reactions to combat. The relation of these to previous emotional disorders is described, and then their recurrence in response to severe stress. A lucid and informative chapter on psycho-dynamics, and another on treatment, conclude this part of the book.

The next section, amounting to half the book, reviews in considerable detail the reactions after combat. The authors gained their experience of this while working in a convalescent hospital in the USA devoted to the rehabilitation of aircrew suffering from war-neuroses. They examine the "return home", the late manifestations of "operational fatigue", and the various states of dependence, guilt and depression, aggressiveness, and quasi-insanity which they noted in their patients. The psycho-dynamics of these conditions are elucidated, and the uses of psychotherapy, "narco-synthesis", and physical methods and hospital routine are expounded. The limitations of the authors' experience are illustrated by their statement that "we have not yet been able to test the efficiency of our treatment in enabling a flier to return to combat": but they seem, subject to this important qualification, to have been successful in restoring a high proportion of their patients to health and good occupational capacity.

The book is written in a clear, descriptive style. It relies greatly on psycho-analytical formulations, translated into untechnical language and making only the briefest overt reference to the libidinal aspect of the psycho-dynamics. It will be of considerable interest to those who have to deal with neurotic reactions to stress; but in its special application to air-force problems, it would perhaps have gained if the authors had paid regard to the published observations of the RAF and other neuro-psychiatrists, which covered a wider experience of combat-reactions than their own.

## NEUROLOGY

### 1068 Introduction to Clinical Neurology

Gordon Holmes. Edinburgh, E. & S. Livingstone Ltd., 1946. vii + 183 pages; 37 figures. 24 x 15 cm. 12s. 6d. [£0.625]

(i) Symptoms and signs; (ii) pathology; (iii) examination of the patient; (iv) the motor systems; (v) muscle tone and co-ordination of movement; (vi) convulsions and other involuntary movements; (vii) examination of the motor system; (viii) sensation; (ix) examination of sensation; (x) reflexes; (xi) the visual system; (xii) movements of the eyes; (xiii) postural reactions and the vestibular system; (xiv) speech and its disorders; (xv) agnosia and apraxia; (xvi) the bladder and rectum; (xvii) the autonomic system; (xviii) mental state. Appendix. Index.

Everyone who has joined the throng which used to follow Dr. Gordon Holmes on his rounds at the National Hospital, Queen Square, London, will enjoy reading this book, and all, however erudite, will gain from it. Dr. Holmes has in this generation been the leading exponent of that form of clinical observation and argument which gave being to the English school of neurology, a school which led to a steady stream of senior students of neurology from every country to Queen Square.

Here is the application of physiological principle to clinical practice, and here is that emphasis upon the accurate observation of function which is so easily forgotten when laboratory methods are substituted for more-fundamental clinical ones. Here also is the elucidation of physiological principles by clinical observation, which will be remembered by so many who attended Dr. Gordon Holmes' ward-rounds and clinics. His personal teaching was so significant that there is no need to enlarge upon this aspect of his work. But the book is intended for students who are now approaching neurology, who have not this personal interest in it.

For them it is no more than its title, an introduction to clinical neurology, but it is an adequate introduction. It deals with fundamentals and the classification of disease has no place in it; in fact diseases are mentioned only incidentally. The eighteen short chapters deal with different aspects of normal and abnormal functions of the nervous system. There are few illustrations, and the prose style is concise and rather hard, so that the student will have to take the reading seriously, but if he does so, his understanding of neurology will be increased. The text would be lightened by more diagrams, and it might be argued that it would gain by inclusion of descriptions of the diseases with which it is concerned. Dr. Holmes' aim was, however, to present only the basis of neurology in this introduction, and he has succeeded in a masterly way in this aim. All who have heard him teach will recommend the book to those who have not.



## OPHTHALMOLOGY

1069 *Lehrbuch der Augenheilkunde*

Ernst Fuchs neu bearbeitet von Adolbert Fuchs. 18. Auflage. Wien, Franz Deuticke, 1945. xvi + 925 pages; 367 illustrations. 25 x 17 cm. Ost.S. 45

1. Teil: Einleitung. (i) Allgemeine Physiologie des Auges; (ii) allgemeine Pathologie. 2. Teil: Untersuchung des Auges. (i) Objektive Untersuchung des Auges; (ii) Funktionsprüfung. 3. Teil: Krankheiten des Auges. (i) Krankheiten der Bindehaut; (ii) Krankheiten der Hornhaut; (iii) Krankheiten der Sklera; (iv) Anatomie und Physiologie der Uvea, Entwicklungsgeschichte des Auges; (v) Krankheiten der Iris und des Ziliarkörpers; (vi) Krankheiten der Chorioidea; (vii) Glaukom; (viii) Krankheiten der Linse; (ix) Krankheiten des Glaskörpers; (x) Krankheiten der Netzhaut; (xi) Krankheiten des Sehnerv; (xii) Krankheiten der Lider; (xiii) Krankheiten der Tränenorgane; (xiv) Motilitätsstörungen des Auges; (xv) Krankheiten der Orbita. 4. Teil: Anomalien der Refraktion und Akkommodation. (i) Brillenlehre; (ii) optische Eigenschaften des normalen Auges; (iii) Myopie; (iv) Hypermetropie; (v) Astigmatismus; (vi) Anomalien der Akkommodation. 5. Teil: Operationslehre. (i) Allgemeine Bemerkungen; (ii) Operationen am Bulbus; (iii) Operationen an den Adnexen des Auges.

A reviewer cannot but be embarrassed in passing judgement on a textbook older than himself. Fuchs' *Lehrbuch der Augenheilkunde* first appeared in 1889, and the present volume is its eighteenth german edition. It has been translated into a number of foreign languages and an english edition helped greatly to mould a generation of ophthalmic surgeons who are only now passing from the scene.

The last three editions of the german text have been brought out by Professor Adalbert Fuchs, a son of the original author. The editor explains that the severe conjunctival and corneal lesions which so dominated ophthalmology at the end of the last century are not frequent now, but that he has hesitated to modify the text on these affections drastically, as his father had so greatly contributed to their elucidation, and his descriptions are used in various parts of the world as a guide to conditions still seen there. On the other hand he appears to have recognized that new problems and attitudes have emerged. The linking of ophthalmology with general medicine, the significance of genetic affections, the description of many syndromes, the emergence of new therapeutic agents, have all been taken into account.

Within the limit he imposed upon himself Adalbert Fuchs has done his task well. The book is still essentially the masterly text produced by his father, and, although note has been taken of new developments, the old framework rather obtrudes. It is this which makes the present volume essentially unsatisfactory. It would be both untrue and churlish to say that the text does not record the immense developments during the last twenty years, but it would be an act of excessive filial piety to hold that the text as a whole reflects them—and a classic is hardly a guide to current practice. It is, however, well to acknowledge that there is no other textbook of this size in ophthalmology which contains such a mass of sound and systematized teaching. Ernst Fuchs was a great clinician, and some of his incidental remarks are revealing even today.

## PATHOLOGY OF INJURY

1070 *The Pathology of Traumatic Injury*

## A General Review

James V. Wilson. Edinburgh, E. & S. Livingstone Ltd., 1946. ix + 192 pages; 61 figures. 25 x 17 cm. £1

Part I. (i) Traumatic shock; (ii) the pathology of burns; (iii) crush injury—traumatic anuria; (iv) fat embolism; (v) blast injury; (vi) the pathology of wounds and wound infection. Part II. (vii) Injuries to the chest; (viii) injuries to blood vessels; (ix) abdominal injuries; (x) injuries to the nervous system; (xi) injuries to bones and joints. Index.

A great deal of work, clinical, pathological and experimental, has accumulated in the past few years on the nature and mechanism of traumatic lesions. Just as it took the stimulus of the 1914-18 war to popularize transfusion, so we may hope that civilian practice will benefit from the lessons learnt in this war.

It takes a good deal of effort, however, to digest even what has already been published, and to assess the very numerous studies, some valuable and others quite worthless, at their proper value. It is impossible to do this without a background of personal involvement in the problems. The author of this work rightly draws from his own experience as a pathologist with the RAMC in the Middle East and on this basis reviews the most important

of the advances made. He has made no attempt "to write a complete text-book covering all aspects of the picture" and, since the book was written abroad, the references are necessarily incomplete. Even so, each chapter has a reference list of between 30 and 100 papers. There are 61 illustrations, many original and some in colour. The main patterns of traumatic lesions are first described; shock, burns, blast, crush-injury, wounds and wound infection and their lesions are discussed on a regional basis, dealing with the special problems raised by the blood-vessels, nervous system, bones, chest and abdomen.

An advantage of wartime pathology is evident, comparing this book with others written by civilian pathologists on the same subject, in that the author was in close contact with clinicians; the book is not a forensic study but promises to be of value to practising surgeons, since one is not allowed to forget that traumatic pathology is not only knowledge about a corpse of use chiefly to coroners, but concerns living patients, the subject of important decisions by the clinician.

If criticism can be made, it is firstly that armchair theorists and purely experimental pathologists receive too large a mention (e.g. in the chapter on shock) and secondly that the author prefers to leave open questions that could perhaps be summarized more succinctly. This is, however, erring on the right side; a personal bias only too easily imposes a uniform perspective on near events which turn out later to be many differing facets of wider and deeper views.

E. G. L. Bywaters

## PENICILLIN PRIMERS

1071 *Penicillin: Its Properties, Uses and Preparations*

Council of the Pharmaceutical Society of Great Britain. London, The Pharmaceutical Press, 1946. viii + 199 pages; illustrations. 22 x 14 cm. 10s. 6d. [£0.525]

Preface. (i) Historical summary; (ii) commercial manufacture; (iii) chemistry and chemical properties; (iv) stability; (v) standard, unit and methods of assay; (vi) pharmacology; (vii) clinical use; (viii) pharmacy and pharmaceutical preparations; (ix) legal considerations. Appendices. Bibliography. Index.

This book has been published under the direction of the Council of the Pharmaceutical Society of Great Britain and provides a concise summary of the available information on the chemistry, pharmacy and clinical uses of penicillin. The information is reliable, well presented and judiciously selected and the anonymous author or authors are to be congratulated on the production of what is undoubtedly the best handbook yet published on this subject.

Now that penicillin has passed the stage of being boosted as "The Wonder Drug" and is taking its proper place among materia medica, it seems that it is likely to maintain its position as the most valuable therapeutic discovery of recent years. The early hopes of the discovery of a series of such antibiotics potent against different types of organisms have not been fulfilled, and except for the still-unproved streptomycin, it now seems unlikely that a rival to penicillin will be found in the field of natural antibiotics. This emphasizes Sir Howard Florey's description of penicillin as "quite one of the luckiest accidents which have occurred in medicine", though this should not in any way detract from the credit due to Fleming, since it seems highly probable that many bacteriologists before Fleming must have seen what he saw on his now-famous Petri dish, without appreciating its significance.

The chapter on commercial manufacture hardly emphasizes sufficiently the magnitude of the technical achievement of the large-scale production of penicillin. The technical difficulties which had to be overcome in adapting a biological process of this kind to a commercial scale are probably known only to those who actually took part in the work. That success was achieved was largely due to a chance observation by Moyer that the addition of corn-steep liquor to the medium gave a greatly increased production of penicillin. This discovery and the selection of high-penicillin-producing strains of mould have made the chief contribution to the increase in titre from the original one unit per ml. obtained by Florey to 200 or more units in modern plant.

The chapters of most value to the clinician are those on Stability, Pharmacology and Clinical Use, which give a clear description of the methods of administration and the precautions to be observed in practice. The destructive effect of certain types of

rubber tubing on penicillin is mentioned, but it is difficult to see what the user can do about it if he is not in a position to have tests of potency performed. Many of the suggestions which have been published for the prolongation of the action of penicillin are described, but it seems that the only method which has found general acceptance is the suspension in beeswax and arachis oil or the modification containing ethyl oleate. The use of hydrogenated cottonseed-oil which has been found satisfactory in the USA is not mentioned. There seems to be a trend towards the use of still higher doses than mentioned here.

A book on a new subject such as this is bound soon to become out-of-date in many respects, and it is to be hoped that the Pharmaceutical Society will issue a new edition before this can happen.

The book is well illustrated with many diagrams and photographs and contains a comprehensive bibliography. No misprint or error has been detected by the reviewer. It can be confidently recommended to anyone who wishes to become familiar with the penicillin story, and should be especially useful to the general practitioner.

Norman Evers

## 1072 La Pénicilline à la Portée du Praticien et son emploi dans le traitement des maladies vénériennes

Jean Monnier. Paris, Librairie J.-B. Baillière et fils, 1946. 148 pages; 26 figures. 24 x 16 cm.

(i) Historique; (ii) production de la pénicilline; (iii) propriétés biologiques de la pénicilline; (iv) comment soigner par la pénicilline; (v) traitement des maladies vénériennes; (vi) traitement des maladies vénériennes (suite). Bibliographie.

This book, by a medical officer to the French naval forces in Britain, opens with a preface by Sir Alexander Fleming, in which he sketches the chain of events in his discovery of penicillin and in its further development by the Oxford team.

The author makes no claim to have produced a "contribution to the study of penicillin". He has simply tried to group together, in a practical order, information which will help the practitioner in France, who has been out of touch with foreign work during the German occupation, to make good use of penicillin when it becomes generally available in that country.

The book falls into two parts, the first four chapters dealing with penicillin from a general point of view, while the last two are devoted to its use in the treatment of venereal diseases. A brief historical sketch of the discovery and development of penicillin, with a note on other antimicrobial substances evolved by fungi and microbes, is followed by a chapter on the production of penicillin and another on its biological properties. The general part of the book ends with a long chapter on the clinical use of penicillin methods of administration, dosage, reactions, bacteriological methods in connexion with treatment and control methods.

Of the two chapters on treatment of venereal disease, which occupy nearly half the book, one is devoted to syphilis and the other to gonococcal infections.

The book is well illustrated with graphs, drawings and photomicrographs, and is well provided with tables. There is a general bibliography of over 150 references and a shorter separate list of references to treatment of venereal diseases by penicillin.

A. H.-S.

## PHYSIOLOGY AND PHARMACOLOGY

### 1073 Estado Actual de la Farmacología Arsenical

A. Esteve & A. Oriol. Madrid, Barcelona, Editorial "Miguel Servet", 1946. 139 pages; 39 figures. 20 x 14 cm.

(i) Química de los arsenicales; (ii) de la química a la farmacología; (iii) discusión de la crisis nitroide; (iv) otro aspecto de la toxicidad arsenical; (v) índices quimioterápicos y el problema de las negativizaciones serológicas; (vi) metabolismo arsenical; (vii) acción idiótópica de los arsenicales; (viii) acción idiótópica de los arsenicales (cont.). Bibliografía.

In this monograph the authors review the pharmacology of some organic arsenical drugs used in therapeutics. After referring to Ehrlich's original researches and to Voegtlin's conception of the conversion of arsphenamine to arsenoxide in the body, they proceed to describe some of the physico-chemical properties of neo-arsphenamine. Numerous titration-curves show the buffer

action of solutions of this drug and the authors point out that the isoelectric points of normal blood and of neo-arsphenamine are the same (isoelectric point pH 7.36). Theoretically, a small change of blood pH could produce a large change in the degree of dissociation of the drug and this, the authors suggest, might account for abnormal reactions which sometimes occur after the drug is injected.

On the problem of nitritoid reactions studied experimentally in the dog, they state that the fall of blood-pressure after intravenous injection of arsphenamine occurs only in the unanaesthetized animal. Thus, anaesthesia with chloralose abolishes the effect but morphine alone does not. The authors believe that the nitritoid reaction is associated with changes in some of the physical properties of the blood such as in the surface-tension, the viscosity and in the electric charge on the globulins. There follows next a discussion of the chemical toxicity and therapeutic activity of arsenobenzenes in which the authors argue that the tests for therapeutic potency need to be applied more rigorously.

Injected arsenobenzenes, such as arsphenamine, are known to be rapidly absorbed by the tissues. The highest concentration of arsenic is found in the liver and spleen, and histological evidence suggests that it is fixed mainly in the reticuloendothelial cells. Much still remains to be discovered about the excretory products of arsenobenzenes in the urine. The last and eighth chapter deals with the affinity of the sulphhydryl group for arsenic and with the value of various antidotes; but it is apparent that information on BAL (2:3-dimercaptopropanol) had not reached the authors in time for inclusion in this monograph.

This monograph contains 72 references and, presumably, is intended for the general reader. Even so, the authors pass hurriedly from one subject to another and give the impression of superficial treatment of the data which they have selected for discussion. There are numerous misspelt words in the list of references.

H. M. Adam

### 1074 Histamina e Anafilaxia em suas relações com a Patogenia das doenças alérgicas

M. Rocha e Silva. São Paulo, Gráfica e Editora Edigraf Ltda., 1946. 331 pages; 56 figures. 23 x 16 cm. Cr. 90,000

(i) Propriedades farmacológicas da histamina; (ii) choque anafilático e fenômenos alérgicos; (iii) mecanismo do choque anafilático; (iv) choques produzidos pela peptona, tripsina e venenos animais; (v) histamina ligada e histamina livre; (vi) efeitos da histamina sobre a pele; papel da histamina na inflamação aguda; (vii) idiossincrasia a drogas e medicamentos; (viii) o problema geral da alergia humana; (ix) substâncias anti-histamínicas e terapêutica das doenças alérgicas; (x) resumo histórico e conclusão. Bibliografia geral. Índice analítico.

In this monograph the author first sets out what is known of the physiological changes that occur in experimental anaphylaxis and allergy, and then discusses how far the experimental facts explain similar phenomena in man.

In 1920, Dale advanced the theory that anaphylaxis was due to the liberation in the tissues of histamine and possibly other pharmacologically-active substances. In tracing the development of experimental work based upon this conception, the author summarizes in the first chapter the pharmacology of histamine and, in the second chapter, the features of anaphylactic shock and other types of tissue reaction. He then goes on to discuss in chapter III the mechanism of anaphylactic shock and the evidence for preformed histamine and its release in the body. This leads him to a description in chapter IV of analogous forms of shock induced by peptone, trypsin and various animal-poisons. This chapter and the next are, perhaps, the most interesting since they embody much of the author's own work on the release of histamine.

Earlier work on the action of trypsin was limited by the impurity of the material. Rocha e Silva was the first to study the pharmacological properties of crystalline trypsin. He showed that trypsin acted in many ways like histamine, that it released histamine in the tissues, and that its effects were similar in many respects to those of anaphylactic shock. These facts suggested that histamine was bound by a peptide linkage to amino-acids, and Bergmann's work on synthetic substrates for trypsin indicated that these might be arginine and lysine. While working in Bergmann's laboratory, Rocha e Silva made a number of chemical models of bound histamine by joining histamine to various amino-acid derivatives. These compounds were all pharmacologically inactive, but became active after hydrolysis, that is, after the liberation of free histamine.

After considering the evidence, the author arrives at the following hypothesis to account for the phenomena of anaphylaxis. Histamine is reversibly bound to amino-acids, probably arginine and lysine, by a peptide linkage. This linkage can be broken directly, by injected proteolytic enzymes, animal poisons or by thermal injury; or, it can be broken indirectly, by antigen and peptone. Now, in the sensitized body, antigen in some way unknown disrupts the blood-platelets and so liberates a platelet kinase which in turn activates plasma trypsin and possibly intracellular protease. These enzymes then attack peptide linkages and liberate free histamine and possibly other substances, which act on cells at or near the site of liberation. We may, indeed, quote the author's words: "the problem today is to know which trypsin or which proteolytic enzyme could really be the precipitating factor".

In Chapter V is included also a discussion of Ackermann's work on the pharmacodynamic groups of the histamine molecule. Chapter VI is on the effects of histamine on the skin and the role of histamine in acute inflammation. Menkin's work on leukotaxine is criticized on the ground that the effect of leukotaxine on the permeability of skin-capillaries could be due to histamine liberated in the skin. The chemotactic property of leukotaxine is not discussed. In the remaining four chapters, drug idiosyncrasy, allergic diseases and antihistamine drugs are dealt with in turn. The classification of the hypersensitive states is based on physiological considerations and is, therefore, logical and simple. The author purposely avoids cumbersome terminology. The chapter on antihistamine drugs will, no doubt, be expanded in future editions. Neoantergan, a potent synthetic antihistamine, which was reported in the literature in 1944, is not mentioned; but this omission may have been caused by wartime difficulties in the exchange of literature.

The monograph is well printed and contains a list of 700 references and 69 illustrations, 4 of which are in colour. The author is to be congratulated for having made a valuable contribution to the literature on histamine and to a large and important part of medicine, for in this monograph are fundamental notions on disease of interest to the physician, surgeon, dermatologist and pharmacologist alike. It is to be hoped that the translation of this work from Portuguese into English will not be long delayed.

H. M. Adam

## RADIOGRAPHY

### 1075 A Descriptive Atlas of Radiographs

An Aid to Modern Clinical Methods

A. P. Bertwistle. Sixth Edition. London, Henry Kimpton, 1946. xxix + 606 pages; 948 illustrations. 25 x 18 cm. £2 5s. [£2.25]

Miles . . . . . Normal bones and epiphyses; (ii) congenital bone; (iv) diseases of bones; (v) tumours of joints; (vi) nasal system; (viii) dental system; (ix) alimentary system; (x) urinary system; (xi) respiratory system; (xii) nervous system; (xiii) vascular system; (xiv) ductless glands; (xv) female generative system; (xvi) muscles; (xvii) medico-legal; (xviii) anthropology; (xix) helminthology. Index.

The author has continued to assemble from many sources radiographs illustrating various pathological lesions, for the most part advanced. Many of the illustrations are first-class. Accompanying each is an altogether too brief account of the clinical history and description of the radiographic appearances. Apart from an increase in the number of plates with their legends, this edition continues to have the book's former defects, for it is based on wrong premises, i.e. that radiology can be learnt by the study of an atlas. Radiology cannot be learnt by the novice from an atlas, however good and comprehensive its illustrations and however full its descriptions, no more than pathology can be learnt from museum specimens.

The radiographic manifestations of disease are infinite, so that an atlas ten times this size, compiled by an expert, would still leave much to be desired by the competent radiologist. Yet the medical man who has not had the training, which is now available at most medical schools, must find the resemblances very confusing, even in the moderate number of illustrations of this volume—a confusion which is not unravelled by the inadequate and in some cases erroneous descriptions—for example, the legend of fig. 399 (p. 278). Because this method of learning radiology has been followed in the past, illustrated descriptions

of many lesions have appeared in the literature under wrong titles, solely because the authors thought that the radiographic appearances resembled those in cases previously described. Such erroneous descriptions and plates have been copied or used in other articles and caused widespread confusion.

As the author indicates in his introduction, early diagnosis is most desirable. Unfortunately the indications of early disease are apparently insignificant, and difficult or impossible to reproduce. Printed by the ordinary methods, an atlas such as this cannot show them. It is difficult even for the radiologist to detect the lesion of old-established disease described, as illustrated in the frontispiece of this book.

James F. Brailsford

### 1076 A Handbook of Radiography

John A. Ross. Second Edition. London, H. K. Lewis & Co. Ltd., 1946. viii + 164 pages; 79 figures. 22 x 14 cm. 10s. 6d. [£0.525]

Preface. (i) Care of the patient; (ii) taking a film; (iii) the dark room; (iv) the extremities; (v) skull and sinuses; (vi) teeth, jaw and face; (vii) the spinal column, etc.; (viii) the thoracic viscera; (ix) the alimentary tract; (x) other abdominal viscera, renal and female genital tracts; (xi) the localisation of foreign bodies; (xii) soft tissues; (xiii) radiography of depth and movement; (xiv) neuro-radiology; (xv) elementary x-ray physics. Appendix. Index.

The author of this small book is to be congratulated on writing a very readable volume which no radiographer could read without deriving some benefit; many would profit considerably from the lessons on the treatment and care of the patient, the taking of the film, its processing in the darkroom and the making of copies. The technique to be observed in taking radiographs of all the bones and joints is so clearly explained and illustrated that the radiographer will have no difficulty in preparing the radiographs essential for the radiologist to give good interpretation. The same can be said of the radiography of the chest, the alimentary tract, the diaphragm and liver, gall-bladder, genito-urinary tract. Various methods for the localization of foreign bodies are described. The special features of stereoscopy, tomography and neuro-radiology are clearly and concisely described and illustrated. The book concludes with a chapter on elementary x-ray physics.

James F. Brailsford

### 1077 Field Service Handbook of Practical Radiography

The War Office. London, His Majesty's Stationery Office, 1945. iv + 141 pages; 146 figures. 18 x 12 cm. 2s. 6d. [£0.125]

Introduction. (i) General preliminaries to x-ray examinations; (ii) the upper extremity; (iii) the lower extremity; (iv) the spine; (v) the thorax; (vi) the skull; (vii) the jaws and teeth; (viii) the thoracic viscera; (ix) the abdominal viscera; (x) stereography and localization; (xi) marking, filing, disposal of radiographs and quarterly reports; (xii) administration of radiological departments; (xiii) photographic aspects of radiography; (xiv) packing of x-ray truck with M.X. 2 equipment. Index. Appendices. Tables.

This small pocket-book was drawn up for the use of men in the armed forces whose duty it was to conduct x-ray examinations in advanced stations. The introduction contains the following healthy comment:—"In forward areas when considering radiology, the fundamental question should be: 'Is an x-ray examination really necessary at this juncture?'" To those who can answer in the affirmative the book is a concise, well-arranged and instructive manual. The essential positions required for demonstrating all parts of the skeleton and for conducting all the routine radiographic examinations of the systems are clearly stated and illustrated. Its very modest price, size and sound instruction are recommended to all radiographers. It can be favourably compared with more expensive volumes which set out to achieve the same object.

James F. Brailsford

### 1078 A Manual of Tomography

M. Weinbren. London, H. K. Lewis & Co. Ltd., 1946. viii + 270 pages; 397 illustrations. 25 x 19 cm. £2 5s. [£2.25]

(i) Introduction; (ii) tomography of the chest; (iii) tomography of the spine; (iv) tomography of the skull and facial bones; (v) miscellaneous; (vi) tomography of the larynx; (vii) technique. References. Index.

In this volume the author explains the physical factors which permit us to obtain a section-radiograph of the body in its long axis at any depth. At the selected level the main outlines of the structures are seen because these are fixed while the structures in front or behind are blurred by movement. The author describes the technique which he has enthusiastically applied to the examination of lesions of the chest, spine, bones and joints, skull including facial bones, larynx and urinary tract. His findings in these many spheres are illustrated with plain radiographs for comparison. A study of these brings one to the conclusion that in only a few cases does the tomograph render what may appear to be additional evidence—in the majority of cases the plain radiographs, particularly when interpreted in the light of other lateral or oblique, give accurate evidence without permitting the radiographs taken in other planes, i.e. antero-posterior with licence in interpretation which may be indulged in with the tomograph. The method is expensive in material and time, particularly in a department busy with routine work. It is very doubtful if there is any evidence of a lesion illustrated by tomography in this book which could not have been at least equally obtained by radiography in one or more planes, or by stereoscopy.

James F. Brailsford

## SERVICES FOR PHYSICAL AND MENTAL HEALTH

### 1079 Neurosis and the Mental Health Services

C. P. Blacker. London, Humphrey Milford, Oxford University Press, 1946. xxii + 218 pages 22 x 14 cm. £1 ls. [£1.05]

Introduction. (i) Origins, history and scope of the survey. Part I: The survey: main findings and their interpretation. (ii) Preliminary notes: circumstances affecting the survey. Presentation of findings. (iii) Main findings summarized: (iv) questions arising from the findings. (v) neurosis in industry. Part II: Post-war psychiatric services. Long-term considerations. (vi) Introduction: (vii) training of psychiatrists. (viii) the teaching psychiatric unit. (ix) the role of the mental hospital in a mental health service. (x) proposed mental health services for a population of a million. (xi) the medical officer of mental health; (xii) accessory services. (xiii) the prevention of mental infirmities: the social problem group; (xiv) miscellaneous. Part III: Post-war psychiatric services: short-term considerations. (v) The post-war transitional period. Part IV: Main findings of the survey. (vi) The post-war transitional period. Index.

Dr. Blacker was entrusted in 1942 with the task of surveying the psychiatric out-patient services of England and Wales. Before long it became evident that the findings would be relevant to the larger problem of how the mental-health services should be developed to meet the requirements of a national health scheme. Consequently the report falls into two parts, the first gives a very detailed analysis of the existing provision which amounted to 216 out-patient clinics very unevenly distributed, and the second embodies recommendations for the growth and better organization of all the mental-health services.

The inequalities in distribution of out-patient facilities were remarkable. Whereas, for example, in Kent and Sussex there were 9.14 clinics per million of population, in the Lancashire and Cheshire region the proportion was 3.66 per million. The number of doctor-sessions per week similarly varied in different regions and for different types of clinic: 4.96 in London, but only 2.05 in the county boroughs outside London, and 1.42 in administrative counties. Measured in relation to the population served, it ranged from 26.7 per million in the London region to 4.94 for Wales. Like disparities were found when the accessory services (such as psychiatric social work), the pressure on clinical facilities, and the number of new patients and patients under treatment in the clinics of different regions were compared. Moreover, the clinics based on mental hospitals had apparently worked under great handicaps, being less well-equipped, holding fewer sessions and seeing proportionately fewer patients than the voluntary or independent clinics.

Dr. Blacker's recommendations are far-reaching. He reviews the needs broadly, and then sets out his detailed proposals for providing an area of a population of a million with comprehensive mental-health services. In the main, he advocates that for such an area a hundred beds should be provided in the first instance elsewhere than in mental hospitals, to accommodate patients who are not acutely ill and for whom certification as insane is not in question: additional beds would be required according

### 1080 Tuberculosis in the West Indies

W. Santon Gilmour. London, National Association for the Prevention of Tuberculosis, [1946]. 221 pages; 13 illustrations. 22 x 14 cm. 7s. 6d. [£0.375]

Foreword. Description of colony; population numbers and racial description; conditions of living; tuberculosis and vital statistics; existing facilities for diagnosis and treatment; tuberculosis survey; recommendations. Appendices. Barbados; Windward Islands: Grenada; St. Lucia; Leeward Islands; Antigua; St. Kitts; Nevis; British Guiana; Bahamas. Summary. Appendix.

This report is based on a visit in 1943-44 to Trinidad and other west-indian colonies (excluding Jamaica), under the auspices of the Colonial Office and the National Association for the Prevention of Tuberculosis. Two-thirds of Trinidad's population of half a million are of african, and one-third of east indian, origin, the former predominating in the towns and the latter in the rural areas. Apparently, housing conditions are still bad for the majority both in town and country; diet is deficient in proteins, vitamins and minerals; parasitic infestation is common; real earnings are low.

The recorded tuberculosis-mortality is 100 per 100,000, which is about 50 % higher than in Britain and double the United States figure; the urban rate is four times the rural. No reliable estimate of total cases in the island is given, but preliminary mass-radiography results indicate an incidence of 6.7 active cases needing treatment per 1,000 of the general public examined. Persons with tuberculosis fall mainly under the care of the Government's general medical services supported by a few clinics run by voluntary agencies and staffed by part-time workers; there is no whole-time tuberculosis officer, no sanatorium or special hospital. A tuberculin survey by the author showed 44 % positive to 0.01 or 0.1 mg. in urban schools and 22 % in rural schools; in the latter, african showed higher rates than did east indian children. The urban-rural contrast is attributed more to the overcrowding of dwellings in the towns than to racial factors. Bovine infection is rare in Trinidad and pulmonary disease is the rule. All stages of the adult type are found, but most are acute, and the average expectation of life after diagnosis is about 2 years; nevertheless, the population cannot now be considered as virgin soil, and successful treatment should be possible in many cases if diagnosed earlier than at present.

Among the author's recommendations, improved housing is given first place, and this should be combined with material inducements for a movement from town back to the land, and with health-education. A scheme for diagnostic clinics and tuberculosis hospitals, with experienced full-time medical nursing, social welfare and other staff, is put forward; and the first sanatorium, already being built, will assist in this scheme. A scheme of maintenance-allowances for the tuberculous, somewhat on the lines of the british scheme introduced during the war, is suggested; also the value of rehabilitation is stressed. It is proposed that the Government shall be responsible for the services, and for any schemes of maintenance, rehabilitation and health-education to the voluntary agencies. In addition to his account of Trinidad, the author records shorter surveys of the tuberculosis position in Barbados, the Windward and Leeward Islands, British Guiana and Bahamas; the last-named colony has the highest tuberculosis death-rate of the West Indies.



# 1081 The Re-adjustment in Civil Life of Soldiers Discharged from the Army on Account of Neurosis

Eric Guttman & Elsie Thomas. London, His Majesty's Stationery Office, 1946. (Ministry of Health. Reports on Public Health and Medical Subjects, No. 93.) 72 pages; 4 diagrams. 24 x 15 cm. 1s. 3d. [£0.0625]

Introduction. The method; army service; present condition; regional differences; causative factors; diagnosis and outcome; treatment and outcome; pension; occupational resettlement; supplementary postal inquiry; further comments and discussion. Summary. Diagrams. Appendices. Tables.

This record of a systematic "follow-up" inquiry has double value, since it not only indicates what social and medical consequences flow from neurotic disability in soldiers, but also demonstrates the method necessary for undertaking a thorough survey of the kind. The sample, consisting of 382 men, was drawn from a variety of rural and industrial areas: each man was visited, nearly always in his own home, by a psychiatric social worker who by persistent effort achieved the result, very rare for this type of field-work, that she succeeded in tracing and investigating every case; and the data were collated with those supplied by the Ministry of Pensions regarding the men's previous health-record. A check on the need for thorough ascertainment by a trained visitor was provided by a concurrent postal inquiry which, though of course much simpler and cheaper, yielded ambiguous and incomplete information.

Three-quarters of the men had required medical attention during the fifteen months after their discharge from the Army. Nearly all the men had to stay away from work because of their ill-health; the absence-rate was over 9 % of the possible working-time. 13 % had changed their job four or more times during the fifteen months: 6 % were unemployed at the time of the inquiry. A tenth of the men experienced serious domestic and social maladjustment, 9 of the men had been sentenced to prison since discharge, but 5 of these had had criminal records before they entered the army. Men who applied for pensions complained more of reduced working-capacity than the rest, but did not in fact differ from the total in respect of sickness-absence or frequency of change of employment.

The report as a whole gives a far-from-reassuring picture of the condition of neurotic soldiers after their return to civil life. But the group was not a normal one before enlistment: it had been characterized by earlier symptoms or breakdown and by poor adjustment to work. The authors of the report stress the need for increased psychiatric facilities for these men but hold that "their problems do not differ in principle from those of other neurotics, and it would not seem advisable to stress unduly the fact that their difficulties are connected with their army service". [Since this report was concluded, further efforts have been made, especially by the Ministry of Labour and the Ministry of Health, to improve the facilities for the industrial resettlement of the neurotically disabled.]

# 1082 National Health Insurance in Great Britain, 1911-1946

R. W. Harris. London, George Allen & Unwin Ltd., 1946. 224 pages. 22 x 14 cm. 12s. 6d. [£0.625]

Part 1. National insurance. Foreword. Introduction. (i) The scheme described; (ii) foundations; (iii) foundations; (iv) (a) types of societies administering the scheme; (b) effects on membership and funds; (v) administration; (vi) finance; (vii) the control of sickness benefit claims; (viii) insurance and national providence. Part 2. National health. Introductory note. (ix) The insurance medical service described; (x) foundations; (xi) the practitioners' remuneration; (xii) the machinery; (xiii) a short note on maternity benefit; (xiv) the insurance medical service; (xv) progress towards an organised medical service for the nation; (xvi) a complete national health service. Appendices.

The author of this book has been officially concerned with British national health-insurance for over thirty-five years. He was one of the civil servants engaged in revising the health provisions of the National Insurance Bill, 1911, and in helping Mr. Lloyd George to convert the Bill into an Act of Parliament. As an assistant secretary in the Ministry of Health he was largely responsible for the central administration of the health-insurance scheme; and since his retirement from the civil service he has been

chairman of the medical service sub-committee of the London Insurance Committee. The book is the outcome of a study of national health-insurance undertaken in 1937 at the request of the Institute of Public Administration, and brought up to September, 1945. It is divided into two parts. The first deals with the administrative, financial, and provident aspects of health-insurance, the second with the insurance medical service created by the National Insurance Act, 1911.

In the first part, Mr. Harris shows that although, when in 1911, we adopted compulsory health-insurance on a national scale, we followed the example set by Bismarck in Germany in 1883—an example that had already been followed by some other continental countries—we did not make a leap in the dark. We had had in Britain several centuries' experience of health-insurance on a voluntary basis for our guidance: voluntary health-insurance in a rudimentary form was provided by the social guilds of the middle ages, and in a more fully developed form by the "friendly societies", whose history can be traced back to the sixteenth century, and whose work was commended in the seventeenth century by Daniel Defoe. Mr. Harris gives an interesting account of the rise and development of the "friendly society" movement, and shows the difficulties encountered by the early workers in the movement. One of the most serious was the lack of a sound actuarial basis for computing the rates of contributions required to assure a given range of benefits. Many societies fixed their rates too low and many became insolvent. From this unsatisfactory position the societies were rescued by the almost super-human labours of a remarkable man, Henry Ratcliffe, secretary and actuary of the Manchester Unity Society from 1848 to 1877; and Ratcliffe's work was followed by that of Sir Alfred Watson, the first Government Actuary, whose analysis of the Manchester Unity experience during 1893-1897 was adopted as the foundation upon which the financial structure of the national health-insurance scheme was erected. Mr. Harris describes the scheme in detail and subjects it to a critical examination, from which it emerges with the conclusion that, though it has not done all that was expected of it, it "has brought about some very definite achievements" and has justified its existence as a precursor of a more comprehensive system.

The second part of the book considers the work of the insurance medical service set up by the Act of 1911, which was a very different thing from what was originally proposed for the medical care of the insured persons. The Bill as introduced into Parliament placed the administration of medical benefit in the hands of the approved societies, thus following the example of the German scheme, on which the British scheme was originally based. At the insistence of the British Medical Association, the Bill was drastically altered to give effect to the basic principle adopted by the Association—namely, that the conditions of insurance medical practice should closely approximate to those of private practice. To this end the Bill, as amended, transferred the administration of medical benefit from the approved societies to specially-constituted insurance committees, each containing representatives of the medical profession, and provided that every registered medical practitioner should have the right to undertake the medical care of insured persons under the scheme, that the insured persons should have the right to choose, and change, their insurance doctors, and that the medical profession should take part in the administration of the scheme. These alterations secured the coöperation of the doctors from the outset; though before medical benefit came into operation, unfortunate disputes had arisen between the Government and the doctors owing to misconceptions that might have been avoided. The British Medical Association, so far from desiring the abolition of medical benefit, has repeatedly urged that it should be extended to include the medical care of the insured persons' dependants and the provision of specialist services.

Mr. Harris gives an informative account of the working of medical benefit. He explains the difficulties against which both administrators and doctors have had to contend, and lays stress upon those arising from the limitation of the medical care provided for insured persons to such services as can properly be rendered by general practitioners. His book, well-written and free from technicalities, is a valuable contribution to the literature of health insurance, and is of special interest at the present time, now that the functions hitherto fulfilled by the national health insurance scheme are about to be widely extended.

G. F. McCleary

1083 **Health and Social Welfare, 1947**

Advisory editor Lord Harder. London, Todd Publishing Company, Ltd., 1946. 527 pages; 1 plate. 22 x 14 cm. £1 ls. [£1.05]

This is the third appearance of the annual reference book, *Health and social welfare*, and the time is opportune for a study of its value. In general this new edition for 1947 follows the plan of its predecessors. Section 1 comprises a series of short articles on medico-social topics; section 2, legislation and policy; section 3, official directories [i.e. directories of official bodies]; section 4, official statements [i.e. statements by official bodies]; section 5, unofficial statements [i.e. statements by unofficial bodies]; section 6, officially-appointed committees and reports; section 7, careers in health and social welfare; section 8, directory of organizations interested; section 9, statistics and tables; section 10, books, periodicals and films; section 11, who's who in health and social welfare.

The table of contents is impressive, and at a first glance the reader will imagine that he has here a reference book for the public health services which will make unnecessary any further consultation of *Who's who*, *Whitaker's almanack*, or the *Medical directory*. But unfortunately a more careful examination discloses that *Health and social welfare*, 1947, is not so comprehensive as it appears and claims to be. The short articles in section 1 might well be omitted, as they are rather out of place in a reference work of this kind. The official directories of section 3 have made a bold attempt to be international (incidentally, although UNRRA appears, there is no mention of the Health Division); but why should Belgium be included and not France, why Southern Rhodesia and not Uganda or any other of the african colonies?

Startling omissions are to be found in section 5, "unofficial statements". The Lister Institute of Preventive Medicine is included, but neither the Oxford Institute of Social Medicine nor the London School of Hygiene and Tropical Medicine (nor is the London School of Hygiene Library included in the list of libraries on pp. 476-478); the Leeds Joint Council on Industrial Medicine, but not the Society of Industrial Medical Officers. Similar criticism could be levelled against section 8 but enough has been said already to indicate that in the reviewer's opinion the selection of organizations to be represented has been made haphazardly. This may perhaps arise from the fact that the publishers have tried to cover too wide a field. In attempting to cover both the fields of public health and social welfare, they have been unable to cover either adequately from the standpoint of essential reference material.

When we come to section 10, books, periodicals and films, the same haphazard selection is evident. Obviously, the book-list in such a volume, as the editors explain, is not intended to be exhaustive. But it could at least have been authoritative, or the basis of selection could have been made plain. Any value that the present list might have and is lost through the inclusion of much worthless, unorthodox, and trivial literature. There are also far too many errors in the bibliographical data. Authors' names are misspelt; the same work appears under different titles; the *Quarterly cumulative index medicus*, which has appeared under its present title for nearly 30 years, appears as the *Index medicus*; while one entry, Smith, M. *Introduction to industrial nursing*, (Cassell) 1943, 7s. 6d., is simply incorrect, as there is no work with such a title by this author. Similar criticism could be levelled against the selection of periodicals. The most surprising omission here is that of the *Bulletin of Hygiene*, an invaluable abstracting periodical covering world literature on public health and related subjects.

With more careful editing, *Health and social welfare* could be a most valuable work of reference. It assembles a mass of useful information, for which search has usually to be made through numerous other works; but the principal need is for a definite basis of selection of the assembled material. The reviewer would like to see included in future editions a list of the university departments, with their personnel, concerned with public health and allied subjects, and details of the various MRC units, while the book and periodical lists should either be omitted entirely or thoroughly overhauled by a competent librarian with a sound knowledge of the literature of public health and social welfare.

H. A. I.

1084 **A Handbook for Assistant Medical Officers of Health on Child Welfare and School Health Work**

1083-1084

F. J. G. Lishman. Second Edition. London, H. K. Lewis & Co. Ltd., 1946. 89 pages. 22 x 14 cm. 7s. 6d. [£0.375]

Introduction. Maternity and child welfare centres; school health service. Appendices. Index.

A second edition of this little book has been made necessary by the changes imposed by the Education Act of 1944 and subsequent regulations made under this Act. The opportunity has been taken, with great advantage to the usefulness of the book, to extend the section on child welfare and especially to give a description of the work of child-welfare centres. Originally the material was used as a handbook for new Assistant County Medical Officers in Devonshire, where Dr. Lishman is Deputy. It would indeed have been unfortunate if it had not been made available in handbook form to all engaged in child-health work. It should serve another purpose, which the author probably did not foresee, and that is to give an insight to the new specialists, whose work will be so closely tied with the child-health programmes of local authorities, into the everyday work of these services.

It is pleasing to find at the very beginning of the book a plea for greater use to be made of the great amount of useful material available for proper statistical analysis in this kind of work, where records are being accumulated of the health, and departures from it, of the whole child population.

The book itself is in two sections—maternity and child-welfare centres and the school health-service. In the first of these, there is a brief description of the usual procedure, followed by a section on infant feeding and the usual difficulties encountered both with mother and with child. This is a plain account and is representative of the best practice in British child-welfare centres. The same can confidently be said of the section on the common disorders of infancy, including difficulties originating in emotional struggles between parent and child, and throughout the whole section from beginning to end, the essentially educative function of the centre is stressed.

The portion of the book devoted to the school health-service follows the same plan. It includes an excellent summary of current practice in school inspection, which mentions the stages in school life at which the children are thoroughly examined, and the system of follow-up with re-examinations of children known to suffer from disability. The action to be taken when it is decided after examination that the child requires some treatment must vary considerably according to custom and facilities in different areas, and the account given here is not so representative as in other sections of British practice.

In a balanced outline of the comprehensive routine physical examination, it is surprising to find the statement that "the otoscope in Periodical Medical Inspection detects a larger number of important defects than does the stethoscope, and may therefore be considered of greater value as a diagnostic instrument." We may forgive Dr. Lishman this eccentricity in view of the great interest which he takes in aural disease and of the value of his repeated writings on its neglect.

The section on handicapped pupils outlines the categories laid down by the Ministry, the procedure of ascertainment and certification, and the regulations concerning the special educational treatment to be provided for the various types and degrees of disability. There is a short account of the extent of the enlargement of the scope of treatment to be provided by the education authorities under the new Act, and of the possible methods of integrating arrangements with those made under the National Health Service Act.

Finally there is a most useful appendix giving specimen forms for administrative and recording purposes, and typical informative educational leaflets for issue to parents.

For anyone overseas who wishes to understand the day-to-day child-health work of British local authorities, this little book can confidently be recommended as the best available.

A. C. Stevenson



**[1029] How Britain was Fed in War Time: Food Control 1939-1945**

Ministry of Food. London, His Majesty's Stationery Office, 1946. ii + 66 pages. 24 x 15 cm. 1s. [£0.05]

(i) The wartime food shortage; (ii) the planning of food supplies; (iii) the economy of national resources; (iv) the machinery of food control; (v) food and the consumer. Appendices.

[For review, see *BMB* 1029.]

**[1030] On the State of the Public Health during Six Years of War. Report of the Chief Medical Officer of the Ministry of Health, 1939-45**

Ministry of Health. London, His Majesty's Stationery Office, 1946. iv + 280 pages. 25 x 15 cm. 5s. [£0.25]

Introduction. (i) Vital statistics; (ii) general epidemiology; (iii) emergency public health laboratory service; (iv) maternity and child welfare; (v) food and nutrition; (vi) emergency medical service; (vii) civil defence casualty service; (viii) problems of medical man-power; (ix) dental services; (x) the nursing services; (xi) morbidity statistics; (xii) advances in therapeutics; (xiii) international health and medical intelligence; (xiv) environmental hygiene; (xv) health publicity; (xvi) planning for the future. Appendices.

[For review, see *BMB* 1030.]

**[1032] First Annual Report, 1945**

Institute of Social Medicine, Oxford. 20 pages. 21 x 14 cm.

(i) (Introduction); (ii) accommodation; (iii) staff; (iv) purposes of the institute; (v) research programme and other current activities; (vi) teaching; (vii) publications; (viii) summary and discussion; (ix) relations of the Institute with Public Health authorities and others; (x) relationship of the Institute and the Bureau of Health and sickness records; (xi) visitors; (xii) programme for 1946; (xiii) changes in the Committee.

[For review, see *BMB* 1032.]

**[1034] Interim Report of the County Medical Officer of Health and School Medical Officer for the Year 1945**

London County Council. London, London County Council, 1946. 64 pages. 25 x 17 cm. 2s. [£0.1]

(i) Introduction; (ii) vital statistics; (iii) general public health; (iv) hospitals and ancillary services; (v) London ambulance service; (vi) school health service; (vii) mental health services. Index.

[For review, see *BMB* 1034.]

## SURGERY

**1085 La Apendicitis en la Primera Infancia**

Joime Damionovich & Alfredo Vidal Freyre. Buenos Aires, Editorial Ilustración Rioplatense, 1945. 231 pages; illustrations. 23 x 16 cm.

(i) Historia; (ii) etiopatogenia; (iii) anatomía del ciego y del apéndice; (iv) anatomía patológica; (v) bacteriología; (vi) cuadro clínico; (vii) sintomatología; (viii) diagnóstico; (ix) formas clínicas; (x) diagnóstico diferencial; (xi) evolución y pronóstico; (xii) complicaciones; (xiii) tratamiento; (xiv) intervención quirúrgica; (xv) apendicitis crónica; (xvi) síntesis final; (xvii) casuística propia; (xviii) casuística argentina. Bibliografía argentina. Bibliografía extranjera.

This clearly printed and well-illustrated book has for its object the countering of the general belief that appendicitis in young infants is very rare and very serious. It is based upon a close study of 61 cases of which 53 occurred in infants under two years of age. They note that the condition is often associated with general infection, especially influenza, and consider that if pain and tenderness in the appendix-area point to inflammation of the appendix it should be treated as a surgical condition. Four-fifths of their cases showed only catarrhal inflammation of the appendix, and this certainly supports the general view that the graver forms of appendicitis are rather uncommon in early infancy. The fact that operation was undertaken early in all these cases perhaps discounts the last-mentioned conclusion.

The authors stress the difficulties of diagnosis and the need for a complete examination in every case; yet they state that they only exceptionally make a rectal examination. In diagnosis they regard spontaneous pain and pain on local pressure as the chief indications of the complaint, but differential diagnosis is fully discussed. Early operation is advised when once the condition has been diagnosed. Operative technique is discussed by Dr.

Adolfo Caballero and Dr. August Wybert; they prefer open ether as anaesthetic and use a modified McBurney's incision. The infant is allowed to be taken home on the second or third day after operation.

General rules for after-treatment are given. Only two of the 53 cases died. A full record of each case is appended and there are many illustrations showing the microscopical appearance of the removed appendix. There is a bibliography at the end.

This monograph deals thoroughly with a difficult subject, and is well worth perusal and study. Readers will probably vary in their opinion as to the urgency of the need for operation in some of the cases, but that very fact should stimulate them to observe their own cases more closely.

V. Zochory Cope

**1086 Minor Surgery (Heath: Pollard: Davies: Williams) for the use of House Surgeons, Dressers, and Junior Practitioners**

Cecil Flemming. Twenty-third edition. London, J. & A. Churchill Ltd., 1946. viii + 406 pages; 209 illustrations. 19 x 12 cm. 14s. [£0.7]

(i) Introduction; (ii) asepsis and antisepsis; (iii) preparation of the patient for operation—the operation; (iv) post-operative treatment; (v) wounds, contusions, burns, accidents, foreign bodies; (vi) haemorrhage; (vii) genito-urinary diseases; (viii) acute abdominal conditions, hernia and scrotal swellings; (ix) minor operations; (x) minor operations (continued); (xi) special dressings, strapping, bandaging; (xii) fractures; (xiii) special fractures, dislocations; (xiv) splinting of joints; (xv) administration of anaesthetics. Index.

This handy little volume provides an excellent guide to the senior student or junior graduate. As in similar books, the title "minor" surgery is capable of wide application, and it is easy to criticise such a book on the grounds of commission or omission. The author has exercised commendable judgement in his interpretation of the phrase.

The following are some points which call for consideration in the next edition. Sodium morrhuate is recommended as the best preparation for routine use for the injection of varicose veins. Allergic and anaphylactic reactions are now well recognized, and in 1942 the Council on Pharmacy of the American Medical Association recommended withdrawal of the 10% solution. We doubt whether drainage of a bone-cyst conforms to modern ideas, as packing the cavity with bone-chips is now more or less universally practised. That most urgent and formidable operation—tracheotomy—is described in commendable detail, but we doubt whether the surgeon need worry about the thyroidea ima artery in the high operation.

Taxis is rather roundly condemned as a measure for the relief of a strangulated hernia. Bowel should not be further damaged unless excessive force is employed, and if circumstances are such that delay in operating is unavoidable, taxis properly applied to a previously reducible inguinal hernia is well worth consideration.

We doubt whether the author really believes that tightly compressing the limb by means of handkerchiefs will occlude the arteries. This is the treatment recommended for an adder-bite, and if arterial occlusion is considered necessary, an improvised tourniquet, described in a previous chapter, should be advocated.

"Tumour" is usually reserved for new growths, and the term should not be applied to the swelling which results from an intussusception.

For the operation of circumcision in infants, the simple and widely applied procedure of crushing the foreskin with bone forceps should be recommended. Surgeons familiar with this method use no other, and the risk of post-operative bleeding is eliminated. A serious omission in the chapter on post-operative treatment is a description of acute dilatation of the stomach—for the want of a little knowledge regarding this condition a patient may easily slip through the hands of an unsuspecting junior surgeon. Also the outlook in a case of hiccough need not be considered as grave until blocking of the left phrenic nerve by local anaesthesia has failed to relieve the condition.

The chapter on anaesthetics is excellent, and contains a full and practical description of all the methods which are commonly employed.

The index is meagre—less than six pages of large print widely spaced. A more complete index would undoubtedly be appreciated by readers.

The above criticisms detract but little from the value of the book, which can be warmly commended to those for whom it was written. It is easy to read, and contains a wealth of information imparted in a pleasant and practical manner.

# 1087 Surgery of the Hand

R. M. Handfield-Jones. Second edition. Edinburgh, E. & S. Livingstone Ltd., 1946. xii + 164 pages; 104 illustrations. 25 x 18 cm. £1

Section I: Infections of the hand. (i) Introduction and general principles; (ii) distal segment of the fingers; (iii) lymphangitis; (iv) infections of the tendon sheaths; (v) infections in the palm; (vi) involvement of the forearm; (vii) some less usual conditions; (viii) complications of infections of the hand; (ix) restoration of function. Section II: Injuries of the hand. (x) Fractures of phalanges and metacarpals; (xi) injuries to soft parts; (xii) amputations; (xiii) burns. Section III: Other surgical lesions. (xiv) Congenital and acquired defects; (xv) tumours. Index.

The grave results of faulty diagnosis and treatment of injuries and infections of the hand have been the subject of much emphasis and teaching during the past 25 years but, in spite of this, there is still, in general, a considerable lack of appreciation of its importance and an acceptance of poor functional results as inevitable. Kanavel's well-known monograph on the subject is the standard treatise but, as the author of the book under review points out in his preface, "the clinical treasures are overlaid with experimental work" which detracts from its value as a practical guide, and for this reason Mr. Handfield-Jones' book, with its emphasis on principles and concise statement of practice, is of great value.

As the title indicates, the book is a treatise on all aspects of the surgery of the hand and, though more than half of it is devoted to the important subject of infection, it also covers other aspects of the subject, including fractures and burns. Since the first edition, the experiences of wartime have produced new ideas and methods, many of which have been incorporated into the new edition now published.

The approach to the subject is essentially practical, with emphasis on the broad principles of preservation and restoration of function, and the author has a concise and pleasant style which makes the book easy to read and assimilate. The principles of surgery are laid down and applied to the various problems under discussion—with a repetition of the warning easily forgotten by those growing up in the present age of chemotherapy that there is still the need for good surgery.

The description of each condition is full and concise. In this connexion it might be suggested that, in future editions, extended use might be made of short tables of signs and symptoms, such as that used in describing the differential diagnosis between distal-pulp infection and acute lymphangitis of the finger-end. If this were applied also, for example, to the description of the differential diagnosis between subcutaneous and tendon-sheath infection, it would enhance the value of the book for ready reference without in any way detracting from its merit as a textbook.

Treatment is clearly described and well-illustrated, and there are useful sections dealing with preventive measures and after-treatment. With regard to the latter, the short notes on the various forms of physiotherapy are helpful. It is probable that a fair proportion of doctors, especially the younger ones, who refer their cases to the massage or electrotherapy department, have not a very clear idea of what really happens to them when they get there.

As is proper in a book which is primarily intended as a practical guide to the general practitioner and house-surgeon, only one method of treatment is described in most instances. This will not be enough for those attempting the higher surgical examinations, who must be prepared to discuss the merits of several treatments with the examiner, but they would be well advised to obtain their basic ideas from this book.

The book is well produced, printed on good paper and excellently illustrated. It can be strongly recommended to those for whom it is written, the general practitioner and the house-surgeon, while the practising surgeon and the candidate for a higher surgical qualification can get much help and good advice from it.

J. W. S. L.

# 1088 Injuries and Diseases of the Oesophagus: being the George Haliburton Hume Memorial Lectures

G. Grey Turner. London, Cassell & Co., Ltd., 1946. 100 pages; 27 illustrations. 22 x 14 cm. 15s. [0.75]

(i) Introduction; (ii) examination and diagnosis; (iii) congenital anomalies; (iv) diverticulae or pouches; (v) foreign bodies; (vi) injuries; by corrosives;

the result of instrumentation; external trauma; (vii) the management of mediastinitis; (viii) non-malignant stricture; (ix) achalasia or cardiospasm; (x) peptic ulcer and inflammatory conditions; (xi) non-malignant tumours; (xii) malignant disease; (xiii) miscellaneous. Conclusion. References. Index.

This work is the book-form of the George Haliburton Hume Memorial Lectures of 1943. The author's modest preface disclaims any intention to produce a complete account of the subject, but it becomes clear on opening the book that this is a masterly account and is the result of over forty years' unrivalled interest in and experience of the oesophagus.

Practically every lesion which may affect the oesophagus is dealt with at some length and is exemplified by case-report of the author's own patients. This characteristic is perhaps the hallmark of the book. Nothing is recommended which has not been fully tried, no statement is made which is not amply supported by a brief note of some illustrative case.

The case-notes are short but the literary style is such as to make a great impression on the reader. "Many years ago . . . I was the very junior member of a trio who drove out from Newcastle in a carriage and pair one Sunday morning . . ." How refreshing are these well-rounded phrases—compare them with some of the breathless, illiterate and ill-considered writings which are only too common today.

These instructive case-accounts will fascinate and enthuse even the most apathetic reader. The book is well illustrated and includes some photographs and drawings of very remarkable specimens. Fifteen shillings seems a high price for a book of under a hundred pages, but the quality amply makes up for the quantity. This book can be confidently recommended, not only to surgeons who are concerned with the management of oesophageal conditions and who will find the greatest help in its pages, but also to general practitioners who have the responsibility of seeing the patients early and determining their fate. A perusal of this book will be invaluable to them—and, if its advice is followed—to their patients also.

R. H. F.

## TEXTBOOK OF MEDICINE

### 1089 Textbook of Medicine by Various Authors

Edited by Sir John Conybeare. Eighth edition. Edinburgh, E. & S. Livingstone Ltd., 1946. xx + 1,170 pages; 66 illustrations. 22 x 14 cm. 30s. [£1.5]

Infectious diseases; tuberculosis; venereal diseases; tropical diseases; diseases due to metazoan parasites; diseases of infants; poisonings and intoxications; disorders of the endocrine system; diseases of metabolism; diseases of the blood, spleen, and lymphatic glands; diseases of the alimentary canal; diseases of the liver, gall-bladder, pancreas, and peritoneum; diseases of the cardio-vascular system; diseases of the respiratory system; renal diseases; affections of the joints and bones; diseases of the nervous system; psychological medicine; common diseases of the skin. Appendices. Index.

Of the popularity of this book among students, particularly of recent years, there can be little doubt. First published in 1929, this is the fourth edition to appear since 1939, and of these, two editions have had to be reprinted. The reason for this is not far to seek. The book is smaller than most textbooks of medicine, the style is clear and the teaching is dogmatic. Whether the student is the best judge of what is good for him may be debatable, but the demand for such a textbook clearly existed and in meeting the demand the distinguished editor of this work has been wholly successful. As it is only eighteen months since the previous edition was published, little radical revision has been considered necessary. The section on tropical diseases and endocrinology have undergone the most radical revision, and a useful addition is an appendix on aviation medicine. A section has also been added on the use of penicillin.

While the teaching is inherently sound, as is only to be expected from the high standing of the team of contributors from the London teaching hospitals whom the editor has collected around him, it cannot be said to be inspiring. The authors, or editors, of English textbooks seem to be incapable of appreciating that dullness and learning are not necessarily synonymous. The practice of medicine is a living subject and if the student is to be inspired with the humanity and humanism of his future career it is essential that his teaching should be humanistic and inspired, and not merely the dull recital of facts divorced from the drama that underlies that doctor-patient relationship of which we are hearing so much these days. Sir William Osler may have had his defects, but his name will always

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## Shorter Notices

### Air Ministry. Principles of anatomy and physiology for physical training instructors in the Royal Air Force

London, His Majesty's Stationery Office, 1946. vi + 180 pages; 158 figures. 25 x 16 cm. 7s. 6d. [£0.375]

The purpose of this manual issued by the Medical Services of the Royal Air Force is to explain certain important principles of anatomy and physiology which are particularly relevant to physical fitness. Chapters I-IV deal with anatomy and physiology, the emphasis being on the functional rather than on the theoretical aspects. In chapter V, posture and corrective exercises, and VI, breathing, reasons for the particular exercises are stressed rather than any specific methods or detailed lists of exercises. Chapter VII deals with mental and physical fatigue and fitness for flying; and chapter IX, with the rehabilitation of medical and surgical cases, describing the general methods and grading of remedial activity. The last part of this chapter contains a short description of some of the common pathological conditions seen at rehabilitation centres. The final chapter attempts to answer some of the common and more important questions asked by physical-training instructors. This work, which stresses the close relationship of anatomy and physiology to physical training, should prove valuable to all instructors as well as to others engaged in physical rehabilitation.

### Demonstrations of physical signs in clinical surgery

Hamilton Bailey. Tenth edition. Bristol, John Wright & Sons Ltd., 1946. xii + 375 pages; 573 illustrations. 23 x 15 cm. £1 10s. [£1.5]

Once again this new edition of one of the most successful works on surgical diagnosis has been considerably revised. The author has still rigidly adhered to his original idea that the book should

convey demonstrations of actual cases, and has brought before the reader many new patients. It is a tribute to the thoroughness and care of the author that he can state in his preface that every one of the 573 illustrations has received individual scrutiny.

This work has now required 10 editions and 7 reprints since it first appeared in 1927; German and Turkish editions have appeared; Spanish, Portuguese, Italian and Greek are in active preparation; and a Dutch edition is being negotiated. We can, therefore, say with truth that Bailey's *Physical signs in clinical surgery* has an international reputation.

### Pye's surgical handicraft

Edited by Hamilton Bailey. Fifteenth edition. Bristol, John Wright & Sons Ltd., 1947. xii + 668 pages; 789 illustrations. 23 x 15 cm. £1 5s. [£1.25]

Over sixty years have passed since the first publication of *Surgical handicraft* by Walter Pye, and of the fifteen editions which have appeared, Hamilton Bailey and his team of eminent contributors have been responsible for the last five. Of the popularity of this work there can be little doubt, for it has served the needs of successive generations of house-surgeons and practitioners.

The object of "Pye" is the same today as it was in 1884, to indicate and illustrate the principles of craftsmanship in minor surgical procedures and manipulation. But if it is to continue to be used with the same confidence, then the work has to be revised thoroughly every few years. In this new edition, by re-arrangement, by revision, by additions, every effort has been made to bring the work thoroughly into line with modern technique, and it can safely be said to represent the best British teaching. A feature of the work is the use of many illustrations, some of them in colour, to present pictorially technical procedures.

### El colapso circulatorio

A. Curieses del Agua. Mahón, Imp. M. Sintes Rotger, 1946. 238 pages. 22 x 16 cm. Ptas. 45.00

This book deals firstly with the mechanics of circulation and defines the term collapse. The author studies the different types of collapse and the causes and diagnosis of each. A chapter deals with the treatment of collapse by [so-called] mechanical methods, e.g. by transfusion of human blood and

heterologous plasma, as well as by surgical means. An account is given of the morphological and physico-chemical alterations which follow collapse, and separate sections are devoted to descriptions of the renal, hepatic, intestinal, pancreatic, cerebral, cardiac and muscular changes which occur. A further section deals with the prevention of collapse. The author also considers the frequency of collapse with reference to sex and age and to predisposing congenital or acquired factors. He emphasizes the need for knowledge on the part of the physician or surgeon of his patients' constitutional make-up and history.

### Psychological medicine: A short introduction to psychiatry

Desmond Curran & Eric Guttmann. Second edition. Edinburgh, E. & S. Livingstone Ltd., 1945. viii + 246 pages; 20 illustrations. 22 x 14 cm. 10s. 6d. [£0.525]

This book, the first edition of which appeared in 1943, is a useful addition to psychiatric literature. It enables the practitioner to familiarize himself with the more practical aspects of psychiatry, and for more intensive study contains a good annotated bibliography.

The new edition has been extensively revised, and a number of sections and chapters have been rewritten and enlarged. The principal alterations and additions were made in the sections on constitutional factors and psychopathic personalities and in the chapters dealing with the affective and hysterical syndromes. Some of the problems of psychosomatic medicine have been briefly discussed, while an entire chapter has been devoted to obsessional states. The appendix on "Psychiatry in war-time" has been retained, as the authors believe that many of the important stresses of war are likely to continue in the postwar world. The book is well produced and contains some excellent illustrations.

### Textbook of medical treatment by various authors

Edited by D. M. Dunlop, L. S. P. Davidson and J. W. McNee. Fourth edition. Edinburgh, E. & S. Livingstone Ltd., 1946. xix + 923 pages; 38 illustrations. 24 x 17 cm. £1 10s. [£1.5]

In the fourth edition of the Scottish school's deservedly popular *Textbook of medical treatment*,

## TEXTBOOK OF MEDICINE

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rank high in the annals of medical history because of his skill in presenting medicine as a living subject.

Apart from this general criticism, which, it should be added, is applicable to many contemporary textbooks, there are two specific ones. In the first place, apart from a few x-rays and electrocardiograms, there is a complete absence of illustrations. No amount of verbal description will ever convey to a student as impressive a picture of, say, thyrotoxicosis, Addison's disease or rickets as will a well-chosen photograph. The vast majority of medical students are picture-readers and not word-readers, yet how seldom does an English textbook make allowance for this. Then again, there is a certain lack of balance in the presentation of the subject. To devote more space to mucocutaneous colitis than to Hirschsprung's disease, to dismiss threadworms in a mere dozen lines, and to devote more space to sarcoidosis than to acute bronchitis, is to give the student an entirely wrong outlook. Anorexia nervosa is a difficult condition to classify, but it is surprising to find it included here under "nervous dyspepsia" along with visceroptosis. There may have been a tendency of recent years to over-emphasize the importance of the endocrine glands, but it is surely swinging the pendulum too far in the opposite direction to devote merely 25 pages to endocrinology and 12 pages to vitamin-deficiency diseases in a book of some 1,150 pages.

Perhaps in preparing the next edition the editor and his contributors may find it possible to devote more time than has been possible during the last eight years to a radical revision of their book which will bring it more into line with modern views on the style, format and presentation of textbooks. Meanwhile we have little doubt that medical students, as well as practitioners, will continue to use it, and in so doing they can depend upon the soundness and the validity of the work.

## USAGE OF DDT

### [1031] Some Properties and Applications of D.D.T.

Ministry of Supply. London, His Majesty's Stationery Office, 1946. 34 pages. 24 x 15 cm. 6d. [£0.25]

(i) General; (ii) physical and chemical properties of D.D.T.; (iii) general review of toxicity; (iv) D.D.T. formulations; (v) means of dispersal; (vi) toxicity to vertebrates; (vii) toxicity to arthropods. Bibliography. Appendices. [For review, see *BMB* 1031.]

### [1031] DDT: The Synthetic Insecticide

T. F. West & G. A. Campbell. London, Chapman & Hall Ltd., 1946. xii + 301 pages; 13 plates. 22 x 14 cm. 21s. [£1.05]

Prologue. History and development. Part I: (i) The basic researches; (ii) manufacture and chemistry; (iii) principles of formulation; (iv) toxic manifestations; (v) D.D.T. in textiles and paper; (vi) D.D.T. against household pests; (vii) D.D.T. against human lice; (viii) D.D.T. against other pests affecting men and animals; (ix) D.D.T. against plant pests; (x) miscellaneous uses of D.D.T.; (xi) effect of D.D.T. upon beneficial insects and phytotoxicity. Epilogue. The way ahead. Author index. Subject index.

[For review, see *BMB* 1031.]

the format of the book has been changed. By using a slightly larger page the number of pages has been reduced, although the actual subject-matter has been slightly increased. Great advances have been made in the last few years in preventive and curative medicine, and their inclusion is necessary in any modern survey of therapeutic methods. But the editors have decided, and decided wisely in a work intended for the student and the general practitioner, that as the experience of some of the new drugs is still necessarily limited, the time has not yet come to omit entirely certain of the older methods of treatment. In this way, the new edition strives to reach a balance between the well-tried<sup>1</sup> old and the new methods of treatment.

A new chapter has been added on penicillin therapy. The sections on venereal diseases and diseases of the thyroid gland have been almost entirely rewritten, and the chapter on the diseases of the respiratory system has been extensively revised. Lastly, a short account has been given in a postscript of the new insecticide DDT.

### Edinburgh post-graduate lectures in medicine

Vol. 3. Edinburgh, Oliver & Boyd, 1946. xi + 587 pages; illustrations. 15s. [£0.75]

The Edinburgh School of Medicine was fortunate in being able to arrange for the delivery of post-graduate lectures at regular intervals throughout the war. The publication of this, the third volume, containing 32 lectures delivered between January 1942 and December 1943, has been delayed owing to the paper shortage. As with previous volumes, the lectures cover a wide range of subjects representing some of the many activities of the Edinburgh School, but we must agree with a reviewer in another journal, who questions the value of such a miscellaneous collection.

### Vers l'infiniment petit

Armand de Gramont. 8me édition. Paris, Gallimard, 1945. 247 pages; 75 illustrations. 160 francs.

This study of microscopy by a member of the Académie des Sciences forms part of the collection, *L'avenir de la science*, edited by Jean Rostand. The first chapter consists of a short essay on Van Leeuwenhoek, "the father of microscopy," and his work. This is followed by an account of the evolution of the microscope from the time of Van Leeuwenhoek to the present day. Chapters III-VII deal respectively with the condenser, dark ground and ultramicroscopy, binocular microscopy, the metallographic microscope and the polarizer microscope. Chapter VIII, which deals with dissociation, staining and fluorescence, includes an account of Dr. P. de Fontrune's micromanipulator, which was described in an earlier number of this Bulletin (see BMB 812). There follow chapters on photomicrography (including radiomicrography and cinemicrography), statistical photography, and interference. Chapter XII deals with Louis de Broglie's "onde associée" and the electron microscope, chapter XIII with bacteria, viruses and bacteriophages, and chapter XIV with disintegration and artificial radioactivity. The book is well illustrated with photomicrographs and diagrams. There is no index or bibliography, but some rather incomplete references are given in footnotes. In a work of this kind, these might, with advantage, have been more numerous and informative.

<sup>1</sup> But the history of therapeutics shows plainly that the fact that a method is "well-tried" does not make it worthy of retention.—ED.]

### Clinical practice in infectious diseases for students, practitioners and medical officers

E. H. R. Harries & M. Mitman. Third edition. Edinburgh, E. & S. Livingstone Ltd., 1947. xi + 679 pages; 56 figures. 22 x 14 cm. £1 2s. 6d. [£1.125]

The second edition of this work was reviewed in an earlier number of the *Bulletin* (BMB 387/44), and in the new edition the whole text has been revised and new matter introduced.

New knowledge in the control and treatment of the acute infectious diseases is now being accumulated rapidly, and the authors have made every endeavour to ensure that the work is completely up-to-date. The chief addition is a new chapter on the pneumonias, and there are descriptions of the common cold, febrile herpes, epidemic nausea and vomiting, epidemic myalgia and infective polynucleitis. The account of penicillin has been considerably enlarged and a brief note added on streptomycin. Inevitably these additions have increased the size of the volume; it is now over 200 pages larger than the first edition published seven years ago. The student, the practitioner and the medical officer will find in it a valuable and up-to-date exposition of modern ideas on infectious diseases.

### Pulmonary Tuberculosis

R. Y. Keers & B. G. Rigden. Second edition. Edinburgh, E. & S. Livingstone Ltd., 1946. xvi + 277 pages; 124 figures. 19 x 12 cm. 17s. 6d. [£0.875]

The publication of a second edition only one year after the first has shown the need for this concise account of the present knowledge of pulmonary tuberculosis. There has been no major development in this particular field of medicine demanding extensive additions of new material, but the opportunity has been taken to revise thoroughly the entire text, and certain sections, those on pathology, epidemiology and resistance, and BCG have been entirely re-written. The number of illustrations has not been altered, but some new x-ray plates have been substituted.

### Aids to dermatology

Robert M. B. MacKenna. Third edition. London, Baillière, Tindall & Cox, 1946. viii + 309 pages; 7 illustrations. 17 x 11 cm. 6s. [£0.3]

This short introduction to the subject has undergone extensive changes in the third edition. In particular, owing to the rapid growth in the knowledge of venereology, that subject could no longer be dealt with in a single chapter, and is now dealt with in a separate volume of the *Students' Aids Series*.

New material has been added and a good deal of revision has been undertaken in this new edition, but the work remains a volume for students and practitioners who require a synopsis of the commoner cutaneous diseases.

### Practical anaesthetics for students, hospital residents and practitioners

J. Ross Mackenzie. Second edition. London, Baillière, Tindall & Cox, 1946. xii + 172 pages; 71 illustrations. 22 x 14 cm. 10s. 6d. [£0.525]

The author of this short manual on anaesthetics, who is lecturer on anaesthesia in the University of Aberdeen, states in his preface that "No departure has been made from the original purpose of the handbook. It is intended as a guide to the elements of practical anaesthetics for students, hospital residents and practitioners and as a survey of the general knowledge in anaesthetics which the

medical student should possess before graduation." This edition has been revised throughout and some additional matter included in several of the chapters with the object of elucidating the text.

### You and your children. BBC talks by a woman medical psychologist

Ministry of Health. London, His Majesty's Stationery Office, 1946. 32 pages; illustrations. 18 x 12 cm. 6d. [£0.025]

This is a paper-bound collection of short BBC talks by a medical psychologist, Dr. Doris Odium, which, to quote the Foreword, "... give simple hints on the handling of normal children—their fears, fads and fancies—and the problems that arise in every family." Basic precepts of the psychology of young children, such as their need for a secure background and for affection, and the most common behaviour-problems, such as faddiness in eating, habit-training and disobedience, are discussed in the simplest terms, sometimes suspect of "talking-down" to the invisible audience. Rather unequal drawings by "Proops", which show children in the practical and make-believe activities of every day, break up the text. This booklet might be of help or interest to parents with little or unenlightened experience of children.

### The M.B., B.S. finals

Francis Mitchell-Heggs. Third edition. London, J. & A. Churchill Ltd., 1947. xvi + 99 pages. 21 x 13 cm. 8s. 6d. [£0.425]

This work is intended for a student working for the final medical examination of London University. It consists firstly of extracts from the University regulations relating to degrees in medicine and surgery, and secondly of a collection of the questions set at the examinations for the years 1932-45, classified and arranged in suitable sub-divisions. As the London degree is recognized as setting a high standard in qualifying examinations, it is likely that this volume will be of use not only to the London student but to those taking the examinations of other British universities.

### Pasteur

Henri Monod. Paris, Editions Correa, 1945. 169 pages; 9 illustrations. 19 x 12 cm. 150 francs.

It is in some ways a strange idea that the anniversary of the death of a great man should be celebrated, but Pasteur was so great that it is perhaps as well that we should seek a convenient pretext for recalling his incomparable achievements. That, at any rate, has been the view taken in France, and one of the products of the 50th anniversary of Pasteur's death is a new short biography by Henri Monod. The author makes no claim to originality for his material, but he provides a readable account of the main features of Pasteur's life, work and spirit.

The author shows the versatility characteristic of many medical writers in the French and other Latin languages. From the list of his other publications given on the fly-leaf it appears that his interests range from cancer of the rectum and gonococcal arthritis on the one hand, to the friendship between Verlaine and Mallarmé on the other hand.

### Aids to the diagnosis and treatment of venereal diseases

T. E. Osmond. London, Baillière, Tindall & Cox, 1946. vi + 138 pages; 4 illustrations. 17 x 11 cm. 5s. [£0.25]

This is a new volume in the familiar *Students' Aids Series*, and as explained above has been separated from the *Aids to Dermatology*. The author, who is honorary consultant in venereal diseases to the British Army, has written this short

work chiefly for the medical student who needs some instruction in the management of venereal diseases.

### Ocular prosthesis

J. H. Prince. Edinburgh, E. & S. Livingstone Ltd., 1946. viii + 134 pages; 76 illustrations. 23 x 14 cm. 17s. 6d. [£0.875]

What little literature in english previously existed on the making and fitting of artificial eyes was to be found only in periodicals, and we are indebted to the author for writing this work. After a short history of the development of artificial eyes dating back to 200 B.C. the author outlines the anatomical and physiological facts essential to an understanding of the requirements of an artificial eye. This chapter may need some revision in future editions, but the author is on safer ground in later chapters dealing with the fitting, the hygiene and the manufacture of artificial eyes. The work undoubtedly fills a gap in opthalmic literature and will be most valuable, especially to artificial-eye makers.

### Aids to public health

Llywelyn Roberts. Fifth edition. London, Baillière, Tindall & Cox, 1946. viii + 259 pages; 4 illustrations. 17 x 11 cm. 6s. [£0.3]

In the eight years which have elapsed since the previous edition of this little work by the Medical Officer of Health of Swindon, many advances both in the theory and practice of public health have occurred.

The basic conception of public health itself is changing with the emergence of social medicine. These imminent changes in practice will inevitably affect the students' curriculum for which this work is intended. But change as the curriculum may, the basic factors of adequate nutrition and healthy environment in the prevention of national ill-health cannot lose their importance, and these factors Dr. Roberts rightly stresses.

### Esquisse d'une histoire de la biologie

Jean Rostand. 2me édition. Paris, Gallimard, 1945. 256 pages; 14 plates. 140 francs.

The author's object, in the present volume, has been to give a concise review of the evolution of biology from the middle of the 17th century to the present day. The term biology has been taken to comprise the three fundamental problems of the formation of the individual, the evolution of the species, and the genesis of life. M. Rostand has already published three separate volumes on the history of these three problems, and this work is here condensed and adapted to form a shortened, coherent account of the general trend of biological progress. Each chapter deals with an individual problem, theory or discovery, and gives an account of the work of the scientist or scientists particularly connected with them. The opening chapter deals with Redi, Leeuwenhoek and the microscope. Other typical headings are: The experiments of Spallanzani; Cuvier and the science of fossils; Charles Darwin and the *Origin of species*; Pasteur and so-called spontaneous generation; Thomas Hunt Morgan and the theory of the gene. A useful feature of the book is a list of the principal dates in the history of biology. There is also a short bibliography, in addition to references given in footnotes, and an index of names. The book is illustrated with portraits of some of the personalities whose work is described.

### Histoire de la science

Pierre Rousseau. 23e édition. Paris, Librairie Arthème Fayard, 1945. 823 pages. 19 x 12 cm. 148 francs.

"L'histoire de la science, c'est la science même." This appropriate quotation from Auguste Comte appears at the beginning of Pierre Rousseau's *Histoire de la science*. M. Rousseau has written this 800-page work from the point of view of one who believes that the history of science is inseparable from the history of human thought. The book takes us from prehistoric times to the age of radio-activity and atomic physics. It is one of a large and valuable series—*Les grandes études historiques*—published by Librairie Arthème Fayard.

### Aids to bacteriology

H. W. Scott-Wilson. Seventh edition. London, Baillière, Tindall & Cox, 1946. vii + 300 pages. 16 x 10 cm. 6s. [£0.3]

H. W. Scott-Wilson, Director of the Laboratories of Pathology and Public Health, London, revised this book by the late Mr. William Partridge for the sixth edition (1938). Since then, as he states in the preface to this new edition, "The intervening six years of war have again focused attention on the subject of wound infection, and great advances have been made in its treatment through the extended use of the sulphonamide group of drugs and the introduction of penicillin . . . The text has been completely revised . . ." After this preface, it is strange to find no entries in the index under, for example, Sulphonamides, Sulphapyridine, Sulphathiazole, or Chemotherapy; search reveals brief references to them in the text. The general description of penicillin is confined to 15 lines, which give nothing of its characteristics. No mention seems to be made of its use against spirochaetes nor actinomycosis (although the latter appears in the index), nor of the chemotherapy of malaria. Brief references to chemotherapy are scattered through the text. The information given is altogether insufficient to aid a student to answer an examination question on antibiotics, which would appear to come within the province of bacteriology. Moreover, no description is given of selective media for isolation of typhoid and dysentery bacilli; and the bacteriological nomenclature is sometimes archaic. As indicated already, the usefulness of the book for ready reference and revision, which would seem to be among its main objects, is very much decreased by the extraordinary incompleteness of the index, which requires extensive enlargement and revision. This member of the *Students' Aids Series*, if it is to be of value to the students for whom it is largely designed, should be revised by someone in immediate contact with their needs.

### Diseases of infancy and childhood

Wilfrid Sheldon. Fifth edition. London, J. & A. Churchill Ltd., 1946. viii + 775 pages; 161 illustrations. 23 x 14 cm. £1 10s. [£1.5]

This work has now become one of the standard textbooks on paediatrics, and the new edition shows evidence of modifications and additions, some of them considerable, in every chapter. Since the previous edition the most noteworthy advance has been the discovery of penicillin, and in order to avoid frequent repetition a brief appendix on penicillin therapy has been added. Chapters and sections that have undergone the heaviest revision include prematurity and diseases of the newborn, intrathoracic tuberculosis, infective hepatitis, intracranial haemorrhage, coeliac disease, fibrocystic disease of the pancreas, and poliomyelitis, while experience of the surgery of patent ductus arteriosus has necessitated more than the original few lines on this deformity. The surgical outlook in relation to oesophageal atresia and chronic lung disease has required modification, while the place of bronchoscopy in intrathoracic tuberculosis has deserved mention. Four new plates and several new text figures have been added. This new edition

of Sheldon will be welcomed by both the clinical student and the general practitioner.

### Penicilina. Compendium din publica- țiunile engleze asupra penicilinei apărute dela 1929 până în 1946

Edited by G. B. Shirlaw. Bucharest, Editura Societății Române de Statistică București, [1946]. 316 pages. 28 x 23 cm.

This collection of rumanian translations of about 150 articles and abstracts on penicillin which appeared in british journals from 1929 to 1946 should be of great help in filling wartime lacunae in rumanian knowledge of english medical literature in this field. The editor, Major G. B. Shirlaw, of the British Mission, Rumania, also points out in his introduction that it is hoped that the literature thus made available will aid in solving the problem of administration involved in allocating the limited quantities of penicillin imported into that country.

The material has been arranged under the following main headings: Discovery of penicillin; preparation of penicillin, preliminary studies, laboratory methods; chemical properties of penicillin; pharmacology and experimental therapeutics; clinical uses of penicillin; surgical applications of penicillin; use of penicillin in medical affections; use of penicillin in special diseases.

An alphabetical index of authors gives the english and rumanian titles and the original references, but contains no cross-references under the names of joint authors; It would have been of help to rumanian bibliographers if the complete reference had been given in all cases; for many references the volume and/or page number is omitted. Moreover, while it would have added another burden to the already heavy task of the compilers, a subject index, even if it contained only the main subject headings, would have increased the value of the compilation for ready reference. Major Shirlaw's introduction, and the foreword, by Air Vice-Marshal D. F. Stevenson, Commissioner of the Mission, appear in both rumanian and english. In spite of the minor criticisms made above, and the presence of some typographical errors, this is a praiseworthy example of international co-operation in medicine. A sturdy loose-leaf binding has been adopted so that users can insert reprints and their own notes into the same volume.

### El enclavamiento intramedular de Küntschers

C. Gil Turner. Madrid, Revista Española de Cirugía, 1946. 90 pages; 18 figures. 22 x 16 cm. Ptas. 25

This book is written by the clinical director of the casualty and orthopaedic department of the Provincial Hospital and of the Clinic of Pathological Surgery of the Faculty of Medicine, Madrid. The author and his colleagues were the first to apply in Spain Küntschers's method of intramedullary nailing in the treatment of fractures of the long bones, as explained by him at the German Surgical Congress in 1940.

The first section of the book gives a short historical sketch of the precursors of this method, from the time of Hippocrates. The remainder of the book deals with the mechanical and biological problems involved, possible complications and accidents which may arise, operative technique and technical difficulties which may be met with in carrying out the treatment. Finally, the author gives details of seven cases of fractures of the long bones dealt with successfully by this method. The book is illustrated with reproductions of x-ray photographs and diagrams, and a bibliography is included.



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## Books Received

December 1946—May 1947

Many of the books listed will be, or have already been, reviewed in the Bulletin

- Abderhalden, R. *Vitamine, Hormone, Fermente*. 1946. Schwabe (Basle), Sw.fr. 14.50
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- Alvarez Sainz de Aja, E. *Lo que todo el mundo debe saber sobre la sífilis*. 1946. Gráficas Gonzalez (Madrid)
- Alvarez Sainz de Aja, E. *La linfogranulomatosis inguinal subaguda a cuarta enfermedad venérea*. 1946. Gráficas Gonzalez (Madrid)
- Appleton, A. B., Hamilton, W. J. & Simon, G. *Surface and radiological anatomy*. 2nd ed. 1946. Heffer, 31s. 6d. [£1.575]
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- Australia Department of Health. *Spiders, ticks, and mites. Including the species harmful to man in Australia and New Guinea*. Section I. Descriptive. . . F. H. Taylor. Section II. Clinical. . . R. H. Murray. (Service Publication Scheme No. 6. Public Health and Tropical Medicine No. 6. University of Sydney)
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- Branco Ribeiro, E. *Estudos cirúrgicos*. 4ª série. 1945. Livraria Atheneu (São Paulo)
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- Burnet, F. M. *Virus as organism*. 1946. Oxford University Press, 11s. 6d. [£0.575]
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# Films

1092

## It's Up To You

made by Nettlefold Studios, 1946; owned by the Admiralty; 16 mm. sound, 560 feet [170 m.]; 35 mm. sound, 1,400 feet [420 m.]; black and white; 15 minutes.

This film was made by the British Navy for showing to sailors who have undergone orthopaedic treatment in hospital and are about to be sent on to one of the naval rehabilitation-centres. Most of these men have little idea of what such a centre is like or what is expected of them. The film shows the day-to-day routine of the centre and, of even greater importance, tries to convince the patients that the speed and completeness of their recovery depend very largely on their own efforts. It starts by explaining in simple terms that for a broken bone to repair itself the junction must be kept immobilized: this is the purpose of the plaster cast. Yet this immobilization must not extend to the neighbouring joints, otherwise the muscles which move over them will become rigid, and, what is more, glue will collect in the joints themselves and so the whole will set solid. Active movement of the joint will increase the blood circulating in the area, and the glue will be washed away. The purpose of the rehabilitation-centre is to put a man back to the job he came from; home-leave will not do that, for the temptation to take it easy will permit the solidifying process to get a hold and he will become crippled. At the rehabilitation-centre a patient will be medically examined on entry, and then given special treatments, graded gymnastics, and games to keep his limbs supple and guide them back to their old agility. The film explains that a patient cannot be a passive participant; he must take an active part in his own treatment if the centre is to achieve its aim and send him out fit for the job he came from—it's up to him!

This film, although obviously of special appeal to the navy, will be appreciated by orthopaedists and physiotherapists in all countries. It shows well how the British concept of rehabilitation envisages an active participation by the patient in his cure, and how the competitive team-spirit is introduced to enhance his keenness; how the doctors no longer treat their patients as diseases to be cured but as people who must be skilfully helped to cure themselves. The inclusion of an explanation why home-leave is not granted will be particularly appreciated, and altogether the film is commended both for its intent and content as an example of the new doctor-patient relationship which is gaining ground in postwar Britain.

B. S.

1093

## Your Children and You

made by Realist Film Unit, 1946; owned and produced by the Central Office of Information for the Ministry of Health, in co-operation with the Central Council for Health Education; 16 mm. sound, 1090 feet [540 m.]; 35 mm. sound, 2,700 feet [810 m.]; black and white; 30 minutes.

This film is one of the series "Your Children's Ears", "Your Children's Eyes" and "Your Children's Teeth",<sup>1</sup> made for the Central Office of Information at the request of the Ministry of Health in co-operation with the Central Council of Health Education. It deals with the upbringing of children during their first few years of life.

First, the parents' interest and co-operation are won by a frank admission of the incessant "giving" they are called upon for the new member of the family. The suggestions start with the reminder that solid foods are much more easily introduced at the age of five months than at that of nine months. The child at this age needs a variety of toys and of things to look at around

him. At one year, the motto given is "It's nice to be praised". A start can be made towards control of excretions, but complete control is not to be expected. A succession of fresh amusements at short intervals is necessary.

At 18 months, the motto is "More knowing than you think". The problems common at mealtimes are discussed in a constructive way. Parents are advised to encourage the small child to help in the housework and garden, it being admitted that the "help" is not very helpful. The common destructive habit of breaking up the home is to be met by giving the child a variety of things to do.

The occasion and methods of punishing are not ignored. The small child is taken to a bedroom and left there (but with the door open, for loneliness begets fear) or a favourite toy is removed for twenty-four hours (but not for longer). A nightlight will make going to sleep easier. A child who overhears an adult's remarks may not understand and appreciate the over-statements casually made. It is necessary to answer the child's question "where do I come from?" simple and directly, even if briefly, and when a new baby is coming the child must be encouraged to look forward to the new arrival, helping beforehand and when it has arrived. The inefficiency of casual threats, which are not put into effect, is noted, and the fact that most naughtiness is boredom.

This is an excellent film. "It sets an ideal, but the advice can be acted on without the parents 'growing wings'". The outlook is up-to-date, with emphasis on praise not blame, but it does not evade the need for punishment at times. It contains much material, and could well be seen by parents several times during the infancy of their child, and especially because much of the good advice is conveyed in a light way, by allusion rather than command. It could be shown to mothers waiting in the outpatient halls at children's hospitals and at antenatal and child-welfare clinics. A handbook giving the script with some stills as illustrations would be a most useful aid.

Ronald MacKeith

1094

## Scabies—1946

made by New Realm Pictures, 1946; owned by Central Office of Information for Ministry of Health; 16 mm. sound, 920 feet [280 m.]; 35 mm. sound, 2,310 feet [690 m.]; black and white; 26 minutes.

The film "Scabies"<sup>1</sup> has been withdrawn and is replaced by "Scabies—1946". The old film has been re-edited and brought up-to-date, and some new material added.

The excellent close-ups of the mite, showing its habits and development, are followed as before by clinical cases showing the typical sites of infestation. Next comes a new sequence showing the range of drugs available for medication and their relative efficiency, and then are shown the methods of applying an emulsion of benzyl benzoate—the drug of choice. A short sequence on secondary infection is followed by an emphatic description of the needs for treating whole families rather than an individual as the infested unit. This new shortened version is an improvement on its predecessor, and is suitable for doctors, nurses and medical auxiliaries.

1095

## Penicillin in Medical Practice

made by Realist Film Unit, 1946; owned by Central Office of Information for Ministry of Health; 16 mm. sound, 1,140 feet [340 m.]; kodachrome; 32 minutes.

The film is divided into three main parts—pharmacological properties of the drug, use in surgical conditions, and use in medical diseases.

In part 1 we are introduced to the parent mould; the pure drug is shown, its physical properties, acid-alkali stability, compatibility with other drugs, and destructibility by the enzyme penicillinase. Next are considered the organisms whose growth is inhibited by penicillin, its efficacy against these organisms, and the methods of testing their sensitivity. Then the various methods

<sup>1</sup> [For reviews, see *BMB* 956, 957, 958.—Ed.]

<sup>2</sup> [For review, see *BMB* 796.—Ed.]

of dispensing are shown: for surface-application; powder, spray, cream, eye-drops, and lozenges; and for systemic injection. Here follow instructions on the preparation of instruments for injection, and details of the techniques available: intramuscular with local analgesic, intramuscular suspension in oil, and intramuscular drip.

Part 2 shows penicillin used for traumatic surgery, burns, mastoid, whitlow, carbuncle and osteomyelitis. Part 3 considers pneumonia, empyema, meningitis, sub-acute bacterial endocarditis, Vincent's angina, impetigo, and varicose ulcer. This section is followed by a short reference to the use of penicillin in venereal diseases and then in ophthalmology. The film ends with a few warnings against abuse of this new drug.

This film is admittedly disappointing: it was intended to appear a year ago as an introduction to the use of the drug, but was delayed and has arrived too late to teach us anything new (so fast have the techniques of penicillin been adopted); the print-quality is poor, the image is jerky, and the captions are difficult to read in the english version. Yet it has its value, for the continual emphasis on the superiority of systemic over local application is good, and each of us will learn one or two more useful facts from the film. It is perhaps unfortunate that no reference is made to the possibility of inducing penicillin-resistant strains by under-dosage.

\* \* \*

## MEDICAL FILMS FROM AUSTRALIA

The New South Wales Committee in Postgraduate Medicine, centred in Sydney, has been for some time investigating the place that films could play in their work. Last autumn a library was started which now numbers over 50 films; these are gathered mainly from USA, with some from Britain and a few produced locally. A film librarian has been appointed, and there is a small preview-theatre attached. An ambitious acquisition-programme is arranged for 1947, and this Committee expects to become the central library in Australia for medical postgraduate teaching films. They have an exchange arrangement with the Scientific Film Association, by whose courtesy we are publishing the two reviews which follow.

1096

### Neurological Sequelae of Deficiency Disease seen in ex-Prisoners-of-War

made and owned by New South Wales Committee in Postgraduate medicine, Sydney, Australia, 1945; 16 mm. sound, 700 feet [210 m.]; black and white; 17 minutes.

This shows the conditions found when Changi Camp was liberated, the cooking facilities, and the food. The dietary composition is analyzed, and then a series of cases is demonstrated. These show a wide range of lesions, including: pot-belly, foot-drop, neuro-muscular incoördination, retro-bulbar neuritis, aphasia, deafness, losses of skin-sensation, absent reflexes, and ankle clonus. This is a simple film which records usefully a wide variety of disorders of rare etiology.

1097

### An Operation for Hydatid of the Liver

made at the Alfred Hospital Melbourne, for Johnson (Aspro) Proprietary, 1945; technical adviser Belcombe Quick, F.R.C.S.; 16 mm. sound, 600 feet [180 m.]; kodachrome; 14 minutes.

Laparotomy reveals multiple adhesions indicating rupture of the primary cyst at some time previously. Two daughter-cysts are detected and removed entire, the liver area is packed off, and the abscess opened. The fluid which pours out is aspirated, and then the mass of cysts is scooped out with a sharp long-handled spoon. After much work all remnants are removed, the cavity is dusted with sulphonamide, and closed by primary suture; it is filled with saline before the last stitch is tied. A drain is placed in the wound, which is closed. The two daughter-cysts first removed are opened: one is dead, but the other contains live cysts; a single bladder is examined, and then a single scolex. This film provides an admirably clear, concise and unhurried demonstration, and the commentary is in keeping. It will provide good teaching-material in countries where this disease is rare.

1098

# Guide to the Journals

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## A message from

SIR WILSON JAMESON K.C.B. M.D. F.R.C.P.  
CHIEF MEDICAL OFFICER, MINISTRY OF HEALTH

*From the health standpoint there is no other single measure which would do more to improve the health, development and resistance to disease of the rising generation than a largely increased consumption of safe milk by mothers, children and adolescents.*

THESE WORDS are a quotation from the First Report of the Ministry of Health's Advisory Committee on Nutrition, 1937. Since they were written, many of the Committee's recommendations have been implemented under the National Milk Scheme and the Milk in Schools Scheme. Not only has the consumption of milk per head of the population risen from 0.41 pint in pre-war days to 0.66 pint in 1946, but the whole pattern of milk-consumption has been changed. No less than 40 per cent. of the total milk-supply of the country goes to the priority classes—expectant and nursing mothers, infants and school children. The effect of this measure on the health of women and children can be seen in the marked fall in the maternal, infant and neonatal mortality rates and in the stillbirth rate; in the improved growth rates and the lowered incidence of dental caries in school children; and in the decline in anaemia in women and children.

I welcome the authoritative statements contained in this symposium. They are written by a group of experts drawn from various branches of science. If our milk-supply is to be increased and made really safe, all of us must play our part—farmers, dairy-technicians, veterinarians, chemists, bacteriologists, physiologists, and indeed the British people themselves.

The symposium will be of special interest to the medical profession for much light may be thrown on problems of human lactation and human nutrition from the study of similar problems in the field of animal husbandry.

*Wilson Jameson*

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# Introduction

THE IMPORTANCE OF MILK as an article of human diet is reflected in the fact that, in spite of many difficulties, it has been the policy of the british government not only to maintain the national level of consumption of liquid milk, but to increase it as compared with pre-war consumption. The introductory message from Sir Wilson Jameson, Chief Medical Officer to the Ministry of Health, which we are very glad to publish at the beginning of this number, amply demonstrates the importance attached to milk by those who have the heavy responsibility of framing a national nutritional policy. A qualitatively and quantitatively adequate supply of milk is an essential

condition of improved standards of health. But the medical importance of milk is unfortunately twofold, for the fluid form and nutritional content which make it such a convenient and satisfactory food for infants also encourage pathogenic micro-organisms to thrive in it and, without the most rigid hygienic control, milk may be a bringer not of health but of disease.

This symposium brings together contributions from specialists whose fields of study are very different, but whose work is all concerned directly or indirectly with milk as a factor in human health. The first paper is by a histologist, and the last by the chief chemist to one of the largest representatives of the dairy-industry. Other contributions come from specialists in endocrinology, biochemistry, bacteriology, pharmacology, nutrition, paediatrics, and public health.

Few, if any, of the subjects discussed could be described as exclusively medical, yet all are of medical importance. The object of this symposium is to provide the medical and any other interested reader with a survey, without reference to artificial vocational distinctions, of the varied scientific problems implicit in the study of lactational physiology in man and animals and in the use of bovine milk as an important article of the human dietary.

The first group of articles is concerned principally with the physiological mechanisms involved in normal lactation. Mr. K. C. Richardson, in an article which covers much new ground, surveys the structural development of the mammary gland from the embryonic stage, and discusses the changes undergone during the various phases of reproductive life. His article is accompanied by an unique series of photomicrographs illustrating the microscopic appearance of mammary tissues during different phases. Dr. S. J. Folley, in a series of three articles covering both endocrine and nervous control of lactation, provides a concise and remarkably comprehensive survey of present knowledge of lactational physiology. This triad of articles contains not only a wealth of positive information, but also interesting discussions of problems that still await final solution. Prof. H. D. Kay, in his review on the biochemistry of milk-secretion, discusses the metabolism of the mammary gland and, particularly, how milk is formed in the mammary tissues from the constituents which reach it from the blood-stream. This is probably the aspect of lactational

physiology which will be most unfamiliar to the majority of readers.

The next group of articles deals with the application of knowledge of lactational physiology in stimulating, inducing or inhibiting the production of milk by the mammary gland. This group includes contributions both from experimental workers on animals and from clinicians. Most of our knowledge on lactational physiology is necessarily derived from animal-experimentation, but the problems of lactation in the human being are—apart from psychological factors which are difficult to assess and the subject of much dispute—essentially the same as those in other mammals. The first article in this group deals with experimental galactopoiesis, a term introduced by Folley & Young in 1940 to denote the stimulation of already-established lactation. The different problem of the experimental induction of lactation in the non-gravid non-parturient animal is discussed by Dr. F. H. Malpress. Dr. Margaret Robinson deals with the application of knowledge won in the laboratory to the hormonal treatment of hypogalactia in the human subject, and Miss Josephine Barnes describes clinical studies on the hormonal inhibition of lactation, with special reference to the use of oestrogens. Readers of this last article should certainly refer also to Dr. Folley's discussion, in section 5 of the second of his articles in this number, of the dual effect—stimulatory or inhibitory according to conditions—of oestrogens upon lactation.

The next small group of two articles deals with milk as a food. Dr. S. K. Kon first discusses the part played by milk in providing dietary requirements, and then considers the effects of such processes as heat-treatment and drying on its nutritional quality. He then passes to consideration of experiments on the gross nutritional effects of milk-supplements to the diets of groups of schoolchildren, and to the place of milk in the national dietary. Professors B. S. Platt & Alan Moncrieff compare on *nutritional* grounds the respective merits of human and bovine milk in infant-feeding. The subject of breast-feeding is so charged with prejudices of emotional and social origin that an authoritative account of the purely nutritional aspects of this question should be of great value. To say this is not to imply that there may not be other considerations which are of considerable importance.



at group of two articles, two related questions are considered—the failure of breast-feeding, and the conservation of human milk through the agency of usually described as breast-milk banks. Dr. Waller has for some years made a close study of lactation in the human, and the views expressed are the product of an unusual experience with the problem. Dr. Jean M. Mackintosh's brief requirements for a breast-milk bank makes it clear the part to be played by such banks in the future is by no means certain.

The contributions mentioned above have been connected in one way or another with the physiological production of milk or with its uses as a food. The following seven articles are concerned essentially with the milk as a vehicle for adventitious substances or organisms. Dr. R. Marrack discusses present knowledge, as yet very extensive, on the presence of antibodies in milk, a subject with obvious clinical implications. Dr. J. H. Burn writes, as yet very little work has been done, although its clinical implications are not inconsiderable. Different views are often expressed on questions which could be decisively settled—for example, whether smoking by the mother may adversely affect the nursling. Dr. J. H. Burn gives a brief but useful survey of the extent of the problem of milk-borne disease in Britain during recent years.

In his article on the bacteriological control of milk, Dr. A. Rowlands is concerned not with milk-borne disease, but with the bacteriology of milk in relation to cleanliness and keeping-quality. Mr. J. McClelland surveys the development of bacteriological standards for milk in England, and gives the essence of the statutory

regulations that have been introduced and the standards that have been adopted. A companion to this is the paper by Dr. J. G. Davis, in which he describes chemical standards and analytical methods for milk, with particular reference to its adulteration by water. Finally, Mr. E. B. Anderson, who is chief chemist of one of the large dairy-combines, compresses a surprising amount of important—but, to the medical reader, largely unfamiliar—information into his article on the various technical processes undergone by milk on its long journey from cow to consumer.

As an appendix to the symposium Mr. W. G. Sutton has provided a bibliography of the literature on lactation and milk. The range of this literature is, as might be expected, enormous, for it includes at one extreme a journal published for goat-fanciers, and at the other the principal British journal in the field of experimental pathology.

Acknowledgement should be made to Dr. S. J. Folley for his helpful advice in the planning of this symposium, and also for the formidable contribution he has himself made to its pages. We are grateful also to the director of the National Institute for Research in Dairying, Professor H. D. Kay, for his sympathetic interest in the symposium, and for having expressed that interest in the practical form of a personal contribution. Several other workers from the National Institute for Research in Dairying have also contributed to these pages, and in another part of this number we give an account of the foundation of the Institute by a medical man, Dr. Robert Stenhouse Williams, who was a pioneer in recognizing the importance of dairy-science to national health. As will be seen from the contributions in this number, much of the Institute's work has developed on fundamental physiological and biochemical lines which are of no less significance to medicine than to dairying.

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## SOME STRUCTURAL FEATURES OF THE MAMMARY TISSUES

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- 1 Embryonic, foetal and pre-pubertal development of the mammae
  - 2 Development during oestrous (menstrual) cycles, pseudo-pregnancy
  - 3 Development during pregnancy
  - 4 The lactating gland
  - 5 Involution
  - 6 Some abnormal variations of growth and differentiation
  - 7 Quantitative estimation of mammary growth
  - 8 Connective-tissue stroma of the mammary gland
  - 9 Mechanism of expulsion of milk
- References

Contemporary accounts of the histology of the mammary glands are nearly always written in relation to the human breast. An outline of the well-known structural variations associated with intra-uterine life, puberty, pregnancy, lactation and involution is given, with perhaps some emphasis on the details of the so-called apocrine type of secretion, and on colostrum-formation. Such aspects as the relatively unimportant nerve-supply, and the clinically very important lymph-drainage, are usually included. An attempt will be made in the following account to focus on those structural details, regardless of their relevance to the human breast, which appear to be significant in current experimental work on mammary development and lactation. The experimental investigation of the mammary gland, whether confined to the endocrine factors responsible for glandular growth and the initiation and maintenance of secretion, or the origin of pathological conditions, including cancer, is complicated by the inherent variability of its tissues, without parallel in other organs of the body.

### 1. Embryonic, Foetal and Pre-pubertal Development of the Mammary

As is well known, these glands arise in the embryos of all mammals, including the Monotremes and Marsupials, from a slightly thickened area of ventral ectoderm extending on each side from the axilla to the inguinal region, distinguished in successive stages as the mammary band, and the mammary streak. This proliferation of surface-cells occurs irrespective of how many functional glands are to be developed, or where they may ultimately be located. From this stage, however, further growth is confined to the mammary lines, which mark out the distribution of the mammae peculiar to a particular species. In the sow, for instance, the mammary lines extend over the greater part

of the mammary streak, but in man and bovines they are confined to the pectoral and inguinal regions respectively. With the appearance of mammary buds as localized proliferations establishing the points of origin of the primary ducts and the nipples in both males and females, and the disappearance of the intervening streak-areas, further development of the mammary glands follows closely the typical pattern of an exocrine gland. It is the extent and pattern of the post-natal phases of development which have been followed so closely in the numerous investigations of the endocrine factors controlling mammary growth (see Folley, 1947a).<sup>1</sup>

We may summarize the foetal and subsequent growth-phases as follows. One or more primary ducts, arising from the ingrowing ectodermal cells of the mammary bud, undergo repeated branching while extending away from the nipple-area into the connective-tissue stroma. These extensions will become the interlobar and interlobular ducts. Further budding from restricted lengths of the interlobular ducts results in the formation first of finer intralobular ducts, and then clusters of alveoli. Thus, the terminal budding of the duct-system determines the size and disposition of the lobules of the gland, as well as reducing or modifying the intervening stroma. In common with the accessory reproductive glands, and unlike the parotid or pancreas, these developmental stages are so slow that, until puberty, little more than the nipple with a system of primary and secondary ducts may be achieved (fig. 1, 2).

There are, of course, variations in different species in the precise mode of origin of the nipple, the appearance of extensive dilatations associated with the major ducts to form teat- and gland-cisterns, typical of the larger domestic mammals, and in the number of primary ducts opening on the surface of the nipple. The main features of development in various species, together with a full account of these variations, will be found in the valuable monograph by Turner (1939). A detailed account of the development of the human mamma is given by Dawson (1934).

Viewing the early developmental history from the experimental point of view, the following problems arise. What is the growth-behaviour of the mammary-bud tissue in the male and female during foetal life and infancy: does it respond, like the more mature gland, to hormonal stimulation? Are the immature epithelial components capable of secretory activity?

It is commonly assumed that the rudimentary mammary tissues are approximately the same in males and females at birth and that, until hormones stimulate their growth, there is no significant development from birth to puberty. Sex differences are distinguishable structurally in some species, however, even as early as the mammary-bud stage. In the cow, according to Turner (1930), the mammary buds in the female are of characteristic shape and are actually smaller than those in the male. Of more immediate importance is the recent discovery that there may be considerable variation in the extent of development of the immature mammary ducts later during the pre-pubertal phase, not only from one species to another, as has long been known, but within different strains of the same species. Richardson & Cloudman (1946) report variations in the degree of duct-development in nine inbred strains of male mice at 6-9 weeks. Possibly these differences may be

<sup>1</sup> [EMB 1100]

traceable even earlier, like those associated with sex differentiation in the bovine embryo.

It is obvious in connexion with the phenomenon of "witches' milk"<sup>2</sup> that the mammary-duct tissue proliferated during foetal life is sensitive to hormonal stimulation at birth. How early this sensitivity and secretory activity is acquired in the foetus does not appear to be known. Schmidbauer (1933) investigating the udder of the freemartin has shown, however, that male hormonal influences, sufficient to modify the genital system, leave the mammary glands unaffected, since the freemartin develops an udder indistinguishable from that in a normal virgin animal. The rudiments of the mamma in the foetus and the newborn possess, therefore, possible inherent genetical variations, and a sensitivity to hormonal stimulation at birth, if not earlier.

A third peculiarity of this immature tissue, already mentioned above, is its ability to undergo secretory activity, and this occurs in the absence of well-differentiated glandular tissue. It is a very common experience in histological preparations to find secretion of both protein and fat in the cells and lumen of the duct-system at almost any stage of development (fig. 8). Are we to regard this secretion as comparable with colostrum, for instance, which appears later when the gland is equipped with secretory alveoli? In this connexion there has been much argument concerning the transient lactation occurring at birth in human infants. Dawson (1934) regarded witches' milk as resulting from little more than the extrusion of desquamating epithelial cells from ducts canalized in the later months of foetal life. It is impossible, however, to ignore the many descriptions of a copious secretion containing fat-globules and other components of milk, which occurs in some infants at birth. Those who have denied that witches' milk is a true secretion have probably been reluctant to regard duct-tissue in its immature state as capable of forming a secretion in the absence of alveoli. Others have interpreted the terminal buds of the duct-system, which often appear to be lined by a single layer of epithelial cells, as transitory alveoli responsible alone for the secretion. As will be shown later, the precise identification of immature alveoli, as distinct from finer ducts and buds, is difficult, particularly in sections. It is now generally agreed that alveoli, comparable in form with the glandular units of the pregnant and lactating gland, appear only after repeated growth and extension of the duct-system, far in excess of what is present at birth (fig. 1). Although larger ducts possess an epithelial lining at least two cells in thickness, these can secrete some at least of the milk components, as Richter (1928) and others have shown from cytological examination. The mammary gland is not unique in showing secretory activity on the part of its duct-epithelium. Rawlinson (1935) has described secretory phenomena in the striated intralobular ducts of the salivary glands, but in this case it is not yet clear what constituents of saliva are released from this source.

It has been established so far that the proliferating ectoderm cells forming the duct-system of the mammary gland may possess inherent differences related to sex, strain and species, together with an early sensitivity to hormonal stimulation, including limited capacity for secretion. Before we attempt to follow the growth of the mammary gland

postpartum, a digression must be made concerning techniques for the histological examination of the immature gland. A very incomplete, and often misleading picture of the growing ducts and alveoli during the immature or pregnant phases is obtained from the examination of thin sections taken from sample areas of the gland. The identification of developing alveoli may be uncertain in sections, and the full extent of the duct-system from the nipple to the terminal buds can be traced from serial sections only by some laborious method of reconstruction. By stripping off the skin of the mammary area, with the underlying ducts or glands in small animals such as the mouse, rat, rabbit and rhesus monkey, it is possible to fix the tissues while pinned out flat, and then to dissect off the skin. A simple staining with haematoxylin outlines the duct-system with great clarity, and the whole preparation can be mounted *in toto* (fig. 2, 3). This technique, first introduced by Lane-Claypon & Starling (1906), was used by Ancel & Bouin (1911) in their studies on the rabbit, since when it has undergone various modifications, notably by Dubois (1941) who describes in detail the precautions necessary for preparing whole mounts of all the mammary glands of a laboratory animal like the mouse, in a condition suitable for quantitative measurement. The value of the whole-mount method has also been recognized by pathologists in tracing the origins and development of mammary diseases, particularly in rodents. There are limitations to the method, particularly where the density of the tissues becomes too great, as for instance in late pregnancy; or in earlier stages where the shape (e.g. guinea-pig) or size of the mamma render it impossible to make a flat preparation. Unfortunately the larger mammae of cows, goats, sheep and humans must be examined in sections, in whole-mounts of rather restricted areas, or by thick slices. Methods for cutting rough serial slices, ranging from 0.5–5 mm. in thickness, using an electrically-driven meat-slicing machine, are described by Ingleby & Holly (1939) for the human breast, and by Schalm & Haring (1939) for the udders of bovines. It is not sufficiently realized by some pathologists that thick (100  $\mu$ ) collodion sections through an entire human breast give a closer approximation to the whole mount than thin sections taken from sample blocks of more convenient size.

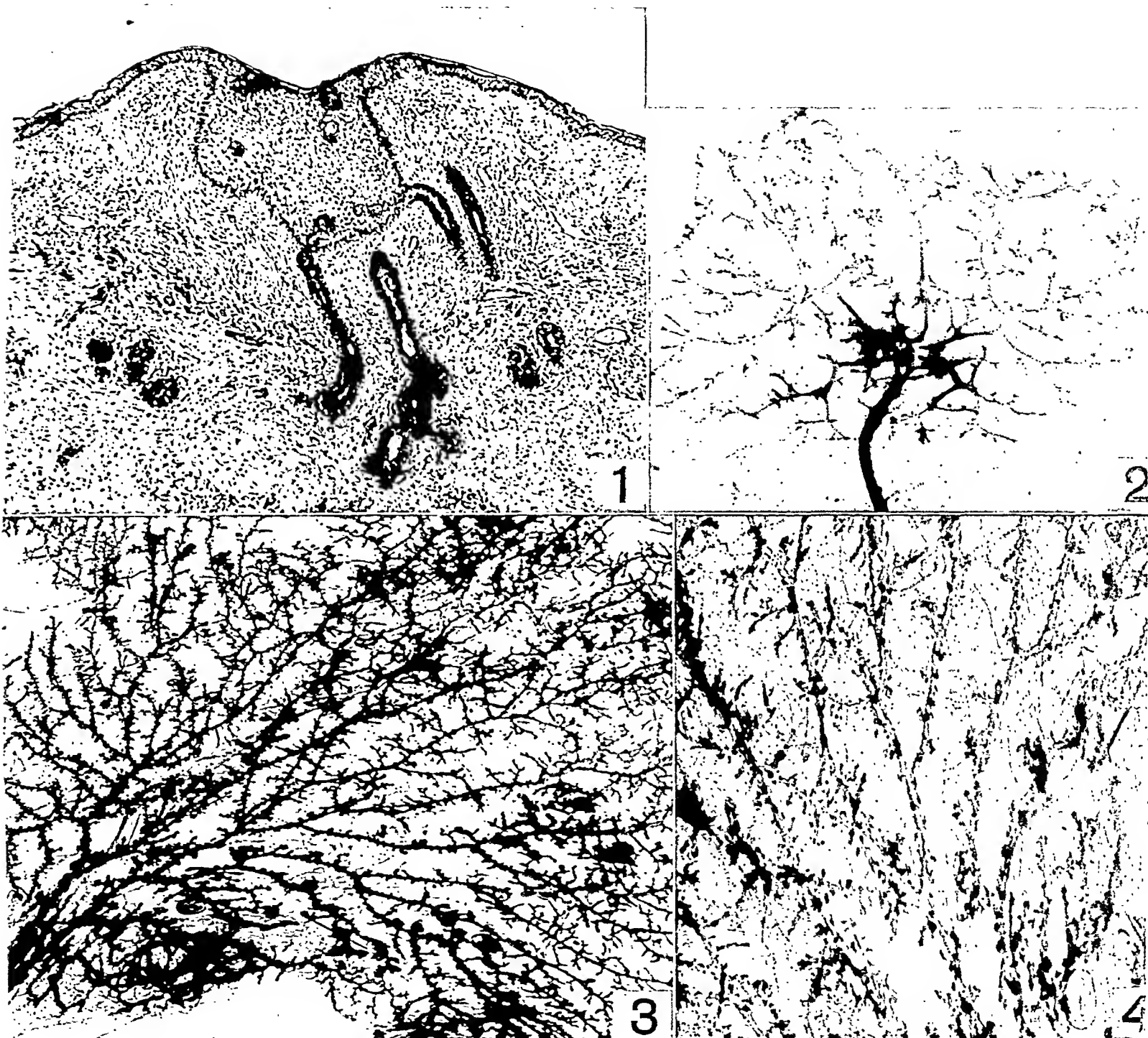
The pre-pubertal phase of the mammary gland in many species is characterized by a static, infantile condition consisting of primary ducts confined to the nipple-area. A very limited growth probably occurs in all forms in conformance with general body-growth. The female ferret and stoat exhibit an extreme degree of inactivity of the ducts, prolonged through the breeding season until pseudo-pregnancy or pregnancy. Amongst the important exceptions are the rat, mouse, calf, goat and monkey, in which the female mammary ducts undergo varying and often quite extensive development, which is usually accelerated in the period immediately preceding puberty. In the males of nearly all species the gland remains undeveloped, but in mice, rats and rabbits the ducts continue to proliferate between birth and puberty. Whatever degree of arborescence of the ducts occurs, it is generally agreed that no alveoli are formed during the pre-pubertal phase. Clearly it is important in researches, aiming at experimental development of the duct and alveolar systems, not to regard immature animals of a particular species as possessing inert mammary rudiments at the commencement of the experi-

<sup>2</sup> [The secretion sometimes seen from the breasts of newborn infants.—Ed.]

# MAMMARY GLANDS IN VARIOUS STAGES OF DEVELOPMENT

(FIG. 1—8)

K. C. Richardson



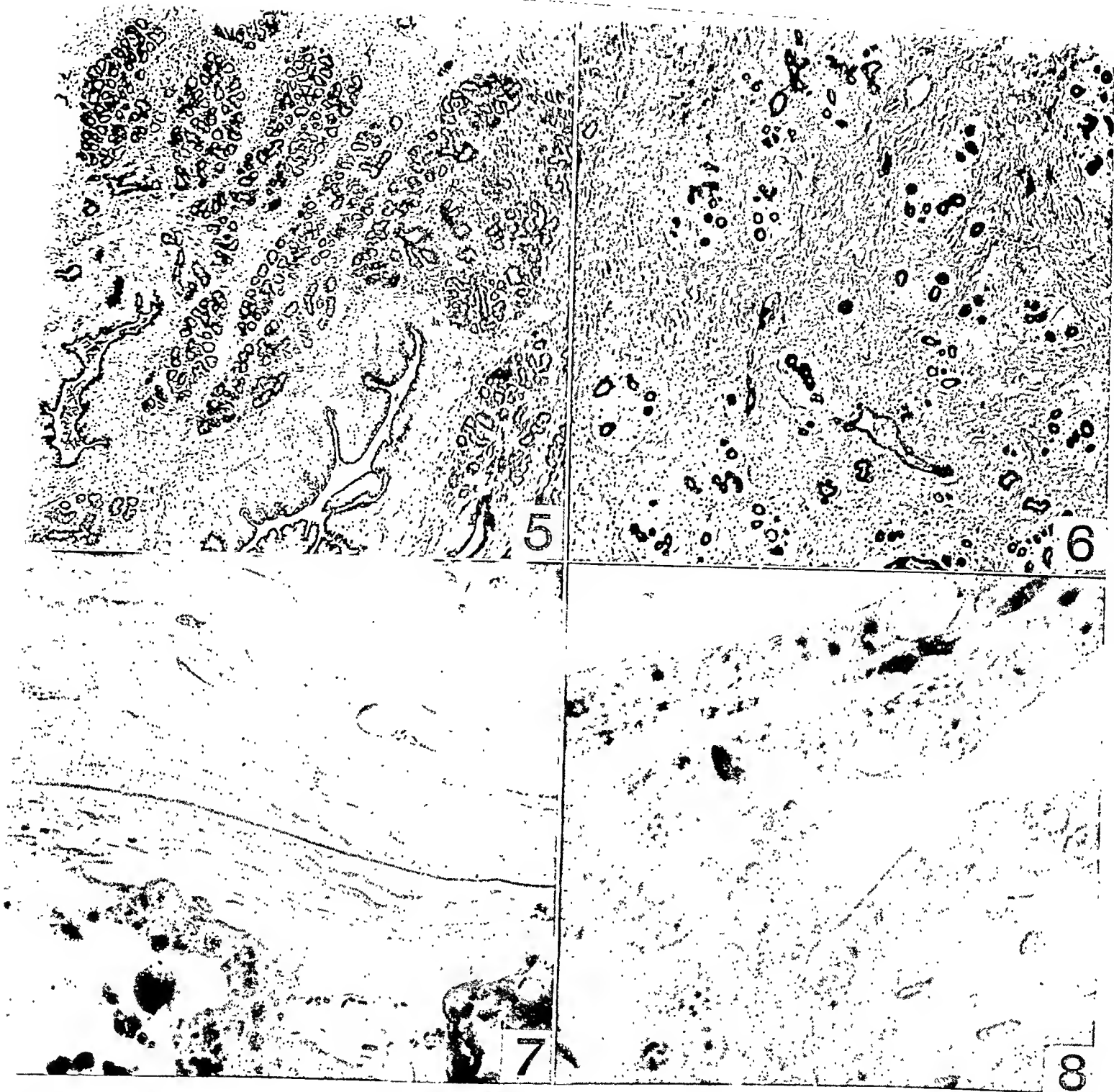
**PLATE I**  
(FIG. 1—4)

FIG. 1. Section of nipple-area (not yet elevated) from a male stillborn infant, showing the rudimentary ducts which are incompletely canalized (magnification  $\times 85$ )

FIG. 2. Whole mount from a young female rhesus monkey approaching puberty (from the series described by Van Wagenen & Folley, 1939)

FIG. 3. Whole mount showing the greater part of a 1st thoracic gland from an adult female rat. (Preparation by A. T. Cowie.) (magnification  $\times 5$ )

FIG. 4. The duct-system from the same gland as fig. 3, at higher magnification



**PLATE 2** (FIG. 5—8) FIG. 5. Section showing growth during early pregnancy in a cat. The lobules are beginning to be outlined by the budding ducts and alveoli. Some large interlobular ducts are seen towards the centre (magnification  $\times 64$ )

FIG. 7. Smooth-muscle fibres, elastic fibres, collagen and blood-capillaries in the interlobular stroma of a goat-mamma

FIG. 6. Section from an adult human breast in the resting stage, illustrating the characteristic intralobular connective-tissue stroma immediately adjacent to the duct-tissue (magnification  $\times 42$ )

FIG. 8. Duct-epithelium in a lactating gland from a goat, showing secretory material in the duct-cells (magnification  $\times 1500$ )

## MAMMARY GLAND DURING LACTATION

(FIG. 9—15)

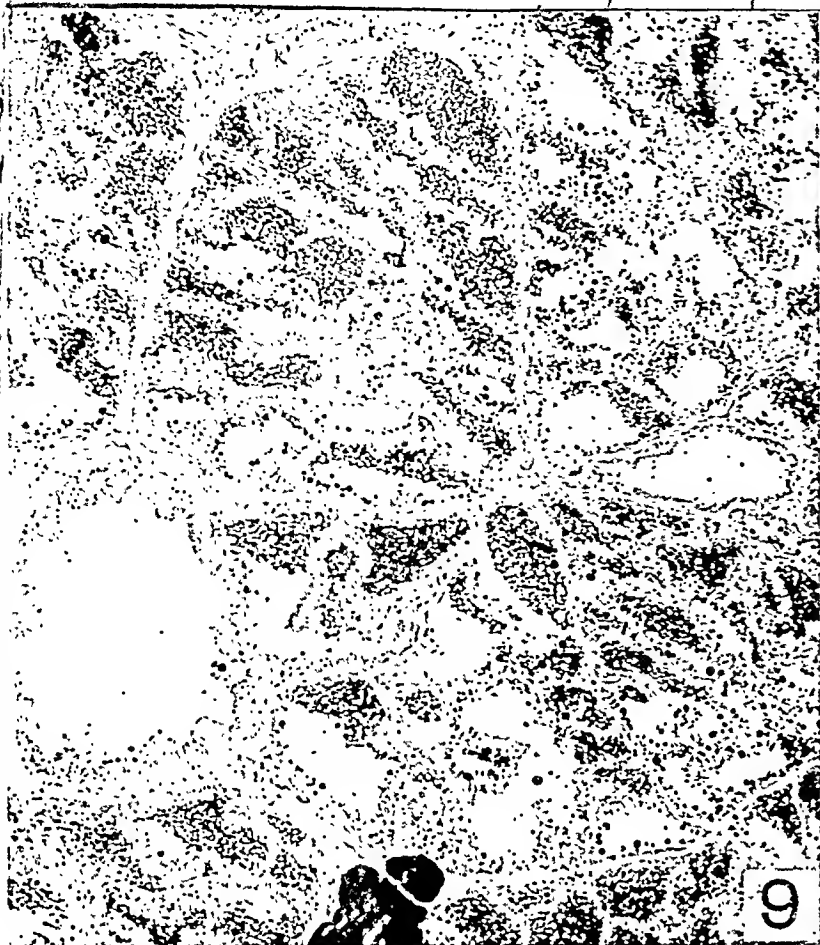
**PLATE 3** (FIG. 9—12) FIG. 9. Section of cat mammary gland in full lactation fixed by Hoerr's technique (1936), and stained with Heidenhain's haematoxylin. Numerous alveoli in lobules are distended with milk showing osmicated fat-droplets. Note the orientation of the fat towards the "upper" pole in most of the alveoli. This is a "creaming" effect which has taken place in the block of tissue before complete penetration of the fixative (magnification  $\times 135$ )

FIG. 11. Lobules from the right half of a goat's udder, fixed by vascular perfusion with Helly's fluid, less than 1 hour after milking (see fig. 12). Note the shrunken alveoli with thick, folded epithelium, and the prominent interlobular septa (magnification  $\times 80$ )

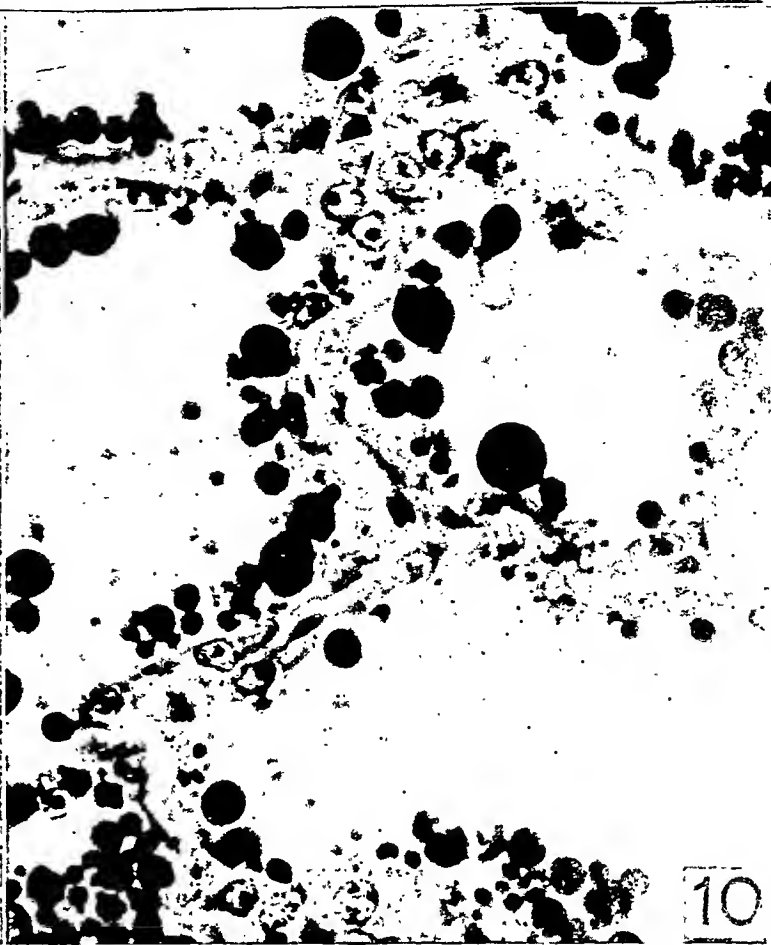
FIG. 10. Alveoli from the same section as fig. 9. Note the grey, slightly granular protein coagulum and black fat droplets (magnification  $\times 700$ )

FIG. 12. Part of a lobule from the left, unmilking half of a goat's udder (see fig. 11) which was distended with milk and fixed by vascular perfusion. Note the dilated alveoli and ducts, and compare with the collapsed condition shown in fig. 11. The two photographs are at the same magnification





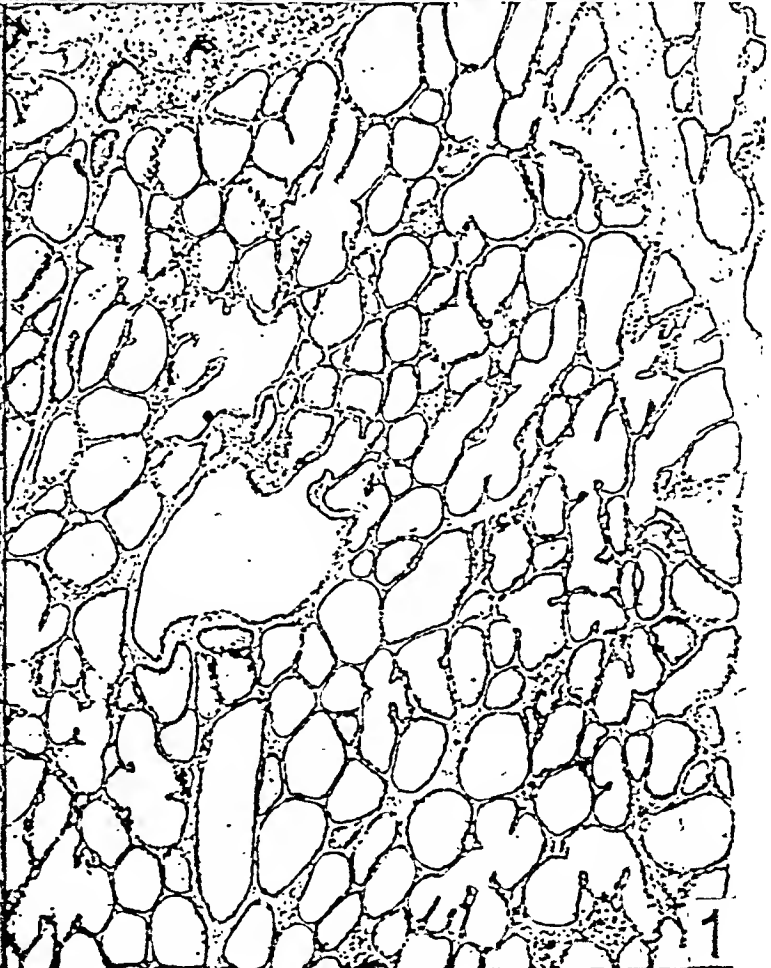
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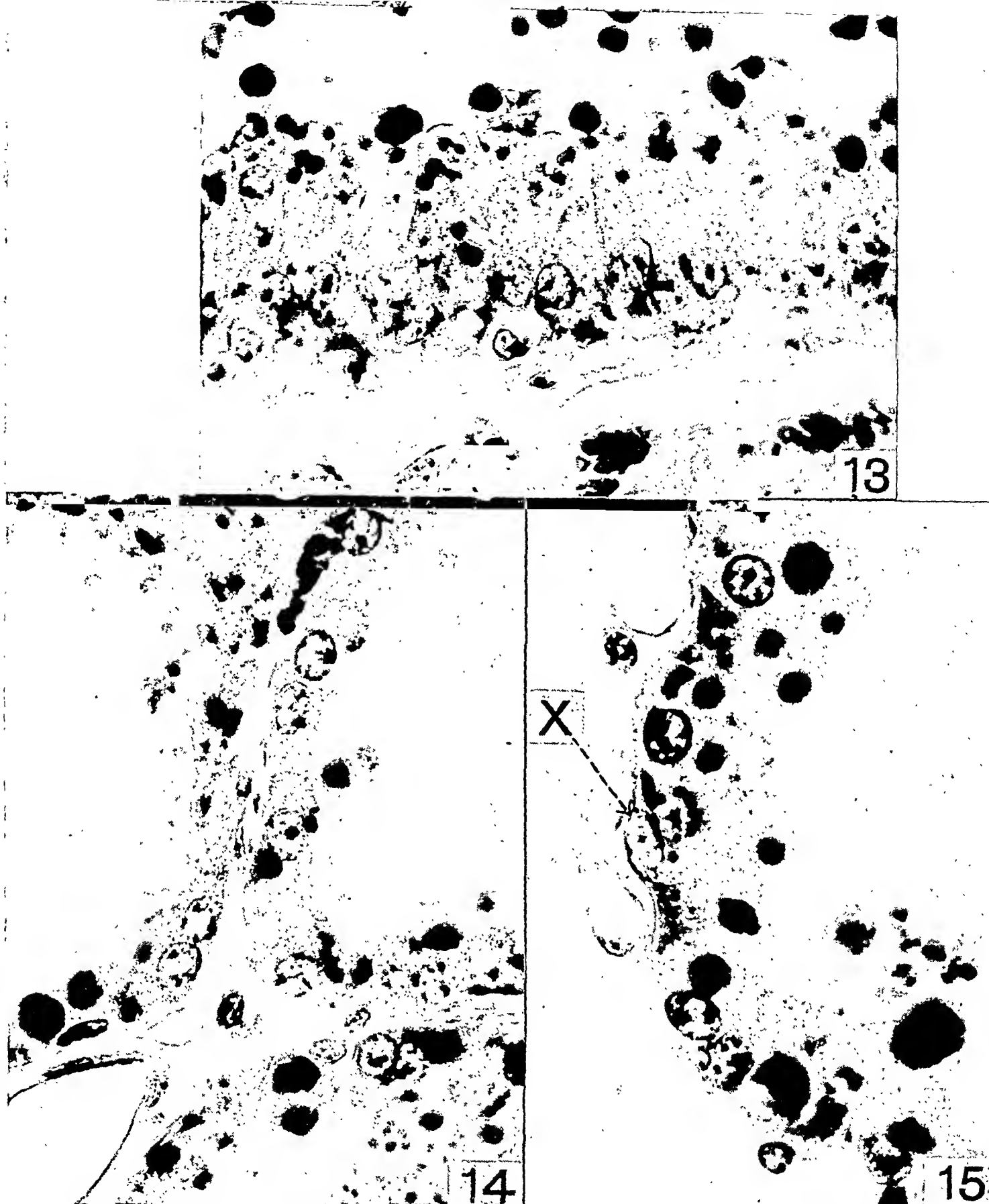


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Photomicrographs by F. J. Pittock, F.R.P.S.

**PLATE 4** FIG. 13. Lactating epithelium from a goat in the early phase of secretion (Hoerr's technique). The cells are tall, and distended with dark-stained fat-droplets and -granules. Some of the fat is about to enter the lumen (magnification  $\times 1500$ )

FIG. 14. Lactating epithelium from a goat, showing the terminal phase of the secretory cycle in a distended alveolus. Note the flattened epithelium (cf. fig. 13) (magnification  $\times 1500$ )

FIG. 15. An intermediate stage of secretion (cf. fig. 13, 14) illustrating also the adjacent blood-capillaries (distended during fixation), the basement-membrane, and a nucleus marked "X" which appears to belong to a myo-epithelial cell lying between the epithelium and the basement-membrane (magnification  $\times 1800$ )

ment without first checking the state of affairs in a given strain or species.

## 2. Development during Oestrous (menstrual) Cycles, Pseudopregnancy

So far we have traced mammary development in the form of epithelial tubes which are easily identified in whole mounts as a branching duct-system, the walls of which are composed of at least two layers of cells. In subsequent phases occurring during oestrous cycles, pseudo-pregnancy and pregnancy, further budding from the sides and terminal ends of the ducts now initiates in varying degrees the formation of lobules composed ultimately of numerous alveoli connected by intralobular ducts to the parent stems. It is a simple matter in many exocrine glands to distinguish precisely the location and limits of the alveolar cells from the epithelium of all the sub-divisions of the ducts. This is more difficult in the mammary gland, and it is questionable whether it can be done reliably in all species, while the gland is still immature, without careful examination of a large range of material taken in various phases. In following the growth of the mammary tree, the inexperienced observer may easily mistake the buds for the leaves. Sections can be most misleading because both the alveoli and the intralobular ducts are lined by a single layer of epithelium, all of it capable of secretory activity. This explains why there is often confusion in the earlier accounts of mammary development in various species as to whether the growth of true alveoli is attained in virgin animals. The prevailing generalization that oestrogens and progesterone stimulate respectively the growth of ducts and of alveoli is often taken rather too literally as indicating that a clear-cut distinction can be drawn between these two components of the gland during their early development.

With recurring oestrous cycles, as sexual maturity is attained, the virgin gland is stimulated for varying periods by oestrogen and progesterone. In most species it is possible to detect growth in the duct-system, the shape and numbers of the newly formed buds being characteristic of pro-oestrus and oestrus in some forms like the mouse. But the growth attained is soon lost by regression, only to be renewed again with the next cycle. A positive balance, so to speak, on the growth-side may result from failure of the ducts to regress completely after a period of stimulation. With the next cycle the mamma starts off somewhat ahead of the basal level of duct-tissue (fig. 3).

The prolonged luteal phase (pseudo-pregnancy), which is a natural feature of the cycle in such forms as the dog, fox and opossum, involves not only duct-growth, but a development of alveoli comparable with true pregnancy. Thus, the lactation occurring in some virgin bitches (Heape, 1906) is not a transient affair, and may be sufficient for the rearing of young. A further variation of some importance is found in those species in which a short or incomplete phase of pseudo-pregnancy can be induced experimentally by sterile copulation or cervical stimulation. In these cases mammary development extends as far as the alveolar growth typical of early pregnancy, but is then followed by regression when the luteal influence subsides.

In primates, successive menstrual cycles lead to the development of lobule-alveolar systems. Folley, Guthkelch & Zuckerman (1939) observed a gradual increase with age in the area of the mammary gland in nulliparous rhesus

monkeys. The first cycles, which are usually anovulatory, were not accompanied by alveolar growth, but after ovulation alveolar tissue was identified. Speert (1941) has concluded from an extensive series of whole mounts of monkey glands that a definite series of cyclic growth changes occurs in fixed relation with the menstrual cycle.

For the human breast, Rosenberg (1922) claimed that premenstrual lobule-alveolar growth was followed by regression after menstruation. Others have denied that there is any clear correlation with the menstrual cycle. According to Dieckmann (1925) the growth, when it occurred, was more closely related to age, so that in some virgin women no lobules ever appeared, while in others lobules once developed were likely to be retained. In a recent account by Geschickter (1945), the histology of the female breast is discussed with reference to changes associated with the menstrual cycle. From an examination of more than 100 cases, of which the time of the cycle was definitely known, this author concludes that there is a proliferative phase of the duct-tissue, together with changes in the stroma, beginning a few days following cessation of menstrual flow. The growth extends through ovulation to reach a climax in the pre-menstruum. Variations frequently found within different lobules of the same breast, or related to hormonal irregularities in different individuals, were noted. Shortly before, or with the onset of menstruation, there is a regressive phase involving shrinkage or desquamation of the duct-epithelium. Thus the human breast seems to fall into line with what has been observed in the monkey. Finally we must add to the picture of conditions in the mature virgin mamma, the well-known anomaly that virgin goats of some pedigree stocks can be brought into lactation solely in response to the stimulus of milking. This species is remarkable for the duct-development exhibited at oestrus, but how far the glandular tissue is developed beyond this point, when the milking stimulus is applied, requires further investigation.

## 3. Development during Pregnancy

The growth-changes during pregnancy will depend on how far the ducts have developed in the virgin animal before fertilization, or to what extent involution has reduced the duct-system after the last pregnancy and lactation. With few exceptions, according to Turner (1939), the first half of pregnancy is occupied by the development of ducts, lobules and alveoli (fig. 5). The last units are in the form of clusters of glandular cells with a small lumen which becomes slowly distended as the secretion is formed. During the second half of pregnancy, secretory activity becomes more and more prominent, increasing the general size of the mamma because the alveoli and ducts are dilated. Some species begin with almost a minimum of duct-tissue, and pass through an extensive phase of budding before lobules and alveoli appear. In these cases (e.g. dog) it probably takes more like two-thirds of the period of pregnancy before cellular proliferation wanes. The cow is remarkable in requiring very little duct-growth to establish the full extent of its lobules. In the goat, secretory activity is unusually late in appearing, so that there is a phase of rapid enlargement of the alveoli at approximately 100 days. The impression gained from a rather limited range of human breasts removed in early pregnancy, is that approximately 5 months are required for lobule-alveolar development

and the commencement of active secretion. The budding of alveoli was observed by Dawson (1935) to begin at about the 10th week, when increase of glandular tissue becomes noticeable clinically.

From the experimental point of view, perhaps the most important feature of structural development during pregnancy in human and other animals is that lobules of individual glands, or even more extensive areas, may fail to reach maturity. Engel (1941) points out that there is wide variation in the architecture of the lactating breast in women and animals which may be missed in sections from areas selected at random. He stresses the value of thick sections of entire breasts in assessing these variations. In the human hypogalactic breast, the glandular tissue in the central region and main body of the gland may be negligible.

#### 4. The Lactating Gland

The structural investigation of mature alveoli in late pregnancy and during lactation (fig. 9, 10) has been pursued repeatedly since about the middle of the last century. There are few examples in the histology and cytology of glandular tissues where so much disagreement has occurred concerning the main outlines of cell-behaviour during the secretory cycle. The finer analysis of cytoplasmic and nuclear changes associated with secretion has been a controversial field in all glands, but in the mammary gland it is the gross structural changes of which we are still uncertain. The problem is of course largely a technical one. The lactating gland is like a sponge soaked in milk. Cutting prior to fixation involves squeezing it, with shifting and extrusion of the stored secretion. When this secretion accumulates in large amounts, it causes the alveoli and ducts to distend (fig. 12, 11). A high milk-pressure, suddenly released by cutting the living gland, will be followed by elastic recoil of the stroma, and distortion of the alveoli. It is curious how few histologists have used material fixed by intravascular perfusion and hardened *in toto*, before isolating the usual small sample blocks for imbedding. So little information is usually given in histological and cytological papers on the lactating gland, as to its state of distension, or whether the material has been taken after a period of rest, or immediately following suckling or milking. The more detailed work has been done largely on rodent glands in which it is difficult to estimate or control these factors. These rather obvious, but often neglected, details of technique have been mentioned, firstly because they are relevant to the interpretation of the normal alveolar secretory cycle, and secondly, as will be shown later, because quantitative estimation of the development of functional alveoli must take into account their state of distension.

It is generally agreed that the alveolar epithelial cell undergoes considerable change in shape, partly at least in response to the distending effect of accumulating secretion, or the collapse which follows its removal. The entire lobule, as well as the alveoli, shrinks when the gland is emptied (fig. 11). If we take the empty stage as the starting-point of a secretory cycle, we find that the alveolar epithelium is often folded, and its cells are so elongated that the apical cytoplasm projects in an irregular fashion into the empty lumen. Soon after the removal of milk from the alveoli, the secretory antecedents accumulate again in the cytoplasm in the form of fat-droplets of relatively large

size (fig. 13), together with less-conspicuous granular protein. As more and more milk is secreted into the alveolar lumen, the cells become stretched, often to a very thin layer (fig. 14, 15). It is the mode of release of the secretory material from the cells which has been so much debated. There are three possible ways in which the secretion may leave the cells to enter the lumen:—the protein, fats and soluble components may pass through an intact cell-membrane; the membrane may be ruptured irregularly to release the larger secretory masses, particularly the fats; or the apical cytoplasm may become detached (pinched off or decapitated), leaving the cell to undergo a rapid phase of regeneration.

It is often forgotten that the same materials are released from the alveolar cells during the secretory phase of pregnancy, though in different concentrations, and at a slower rate. Grynfeldt (1937a) has investigated the cell-changes in the alveolar and duct epithelium during pregnancy. He points out that a basal secretion of protein granules is transported from the cells to the lumen without obvious breakdown of the cytoplasm or cell-membrane. Large fat-droplets, appearing sporadically in less concentration than in the lactating gland, are also extruded without causing the "ragged" surface so characteristic of the lactation-phase. Is the so-called apocrine type of secretion a consequence of the more rapid rate of secretion in the lactating gland; an effect of suckling; or an insignificant process on the part of some over-active cells exaggerated by technical manipulation? Unfortunately conditions are unsuitable for direct observation of living alveoli, as can be done with glands like the intact pancreas. It is probable that in any case the fat-droplets would hinder resolution sufficiently to make the method unreliable.

We must be content to follow the opinions of authors who have re-examined the problem of alveolar-cell behaviour in recent years. Jeffers (1935) describes a cell-cycle, for instance, in the rat which involves a decapitation of the apical cytoplasm during the early stages of secretion when the cell is still elongated. In collapsed alveoli, however, when a fresh cycle of milk-secretion is beginning, it is common to find the epithelial cells cut in various oblique planes. Thus "decapitation" may result from the section-cutting. Unless some form of reconstruction is attempted from serial sections, the apparently isolated patches of cytoplasm containing secretion, which have been so often described in the lactating alveolus, should be interpreted with caution. This is especially so when the material has already been disturbed by attempting to cut it into small fragments for so-called cytological fixation. On the other hand the extrusion of large fat-droplets from the cytoplasm does appear to result in a rupture of the cell-membrane, if we are to interpret the ragged appearance of the fixed and stained lactating epithelium as not due entirely to a technical artifact following extraction of fat. Grynfeldt (1937b), however, distinguishes two types of fat-secretion. He interprets the ruptured appearance of the cell-membrane as brought about by rapid withdrawal of the secretion during suckling. Cells which are not injured in this mechanical way appeared to him to release their fat more gradually, without obvious destruction of the cell-membrane. The effects of suckling were, however, surmised rather than investigated under controlled conditions. Even this effect of a ruptured membrane may be due to, or exaggerated by, inadequate technique during fixation and imbedding. It is

useless to argue further on these points until more is known of the factors controlling the secretion of fat and protein in the milk. If it were possible by some experimental means to suppress or augment the secretion of one or other component independently, we might get further information to settle the controversy. It is fair to say that the apocrine mode of secretion has probably been much over-emphasized, if it occurs at all.

Our interest in the structural behaviour of the alveolar epithelium is concerned, however, with more than the mere academic problem as to whether the mammary glands fit into the apocrine group. We must know the details of the secretory cycle, for instance, to account for variations in the composition of milk. Do all the epithelial cells of an alveolus undergo the different stages of the secretory cycle in unison, or at random? If wholesale decapitation of alveolar cells is the rule in secretion, what is the rate of regeneration, and how long is the interval before a new cycle of secretion is possible?

Turner (1935) has put forward a theory of milk-secretion for the domestic animal which, whether right or wrong, serves to illustrate how the structural behaviour of the alveolar cells may be significant in explaining variations in milk-composition. This theory depends on the assumption that the intra-alveolar pressure resulting from accumulation of milk slows down the rate of secretion, possibly owing to pressure on the capillary blood-vessels. If the interval between milkings is sufficient for regeneration of the cell-membrane, ruptured previously during the active phases of secretion or withdrawal, the alveolus in its distended state will reach a stage when fat-droplets are unable to pass freely through the re-constituted cell-membrane, although other components of milk may continue to do so at a retarded rate. There may be a relationship, in other words, between alveolar pressure and slowing of secretion, with a selective inhibition of the release of fat. When the milk-pressure is low, the fat-content will be high; but as the interval between milkings is extended, the fat-content of the total yield will be reduced by dilution of the milk with water and substances which can pass freely through an intact membrane.

### 5. Involution

Involution of the mamma begins rapidly following failure to withdraw the secretion. The structural changes involved in the reduction of a fully-developed gland to a resting-condition roughly comparable with that in the virgin animal have not been investigated in quite the same detail as those associated with the reverse processes of growth and lactation. The main outlines are, however, well known. From detailed study of involution in the mouse, Williams (1942) has shown that the regression is more rapid if the young are removed at birth, before suckling can begin, than if weaning occurs during the height of lactation. There is a temporary phase of secretory engorgement, during which the protein coagulum in sections becomes more intensely staining, followed by absorption of the milk and collapse of the alveoli. The epithelium appears to disintegrate in various ways by vacuolation and pycnosis, frequently forming coalesced masses of cells when the alveolar pattern is destroyed. In the domestic animals, which are milked regularly, the involution is more gradual, spreading slowly through the gland and reducing the active tissue unevenly

(see Lenfers, 1907). According to McFarland (1922), involution rarely proceeds uniformly in the human breast. A few lobules may remain for one year following birth, and vestiges of lobules may be found even in advanced age.

### 6. Some Abnormal Variations of Growth and Differentiation

It is not proposed to carry this account into the extensive field of mammary pathology, but it should be stressed that, as a result of experimental work on the hormonal factors controlling mammary development and lactation, some at least of the well-known pathological changes observed in the human breast have been induced in identical or closely-similar form in animals. Mammary epithelium is so sensitive to the action of hormones that the pattern of its growth, and indeed the structural differentiation of its cells, may become abnormal. Apparent over-stimulation, following excessive dosage with one kind of hormone, or failure to give correctly-proportioned dosages where two or more hormones are concerned, may result in effects of this kind. For optimum growth of the duct-system, for instance, it seems clear that the oestrogen-dosage must be kept within fairly narrow limits. High dosages result in the mouse and monkey, as Gardner, Smith & Strong (1935) and Gardner (1941) have shown, in the development of stunted glands (see Folley, 1947a). From such abnormally developed duct-tissue, cystic dilations may arise. The mammary alveolus also can grow abnormally, even although normal milk-secretion is ultimately attained. Thus, Mixner & Turner (1943) found abnormally enlarged alveoli with characteristic proliferations of the epithelium developing in virgin goats brought into lactation by the administration of oestrogen. Structurally, these abnormal alveoli appear to be similar to the cystic alveoli of the human breast, regarded by McFarland (1922) and others as residual lactation-alveoli, which had failed to involute, and had become dilated by persisting secretion. Even the epithelial folding is identical, being due in all probability to the disruption of inter-alveolar septa rather than a papillomatous proliferation. The human condition may in fact be a feature of atypical growth occurring before lactation, rather than an abnormal persistence of alveoli following involution. Turning to the mammary epithelial cell itself, we find a possible link between the pale or "pink" granular epithelium commonly found in cystic disease of the breast (see Lendrum, 1945) and a similar cellular change described by Speert (1942) in monkeys, after prolonged oestrogen treatment. If these two variants of mammary epithelium are identical, the experimental material would seem to show that the change begins during the growth-phase before the alveoli mature, probably at a time long before cystic enlargement is established.

### 7. Quantitative Estimation of Mammary Growth

Both in the fields of normal development and of pathology, the qualitative description of growth and differentiation in mammary tissues should be supplemented where possible by more experimental work involving quantitative measurement. Gardner & Strong (1935), Van Heuverswyn, Folley & Gardner (1939), Folley *et al.* (1939), and Dubois (1944), are amongst the few authors who have attempted to express mammary growth in semi-quantitative form. The last two papers quoted above deal with surface-area

measurements obtained from whole mounts. But growth occurs also by densification of the mammary tree; due to budding of vast numbers of off-shoots eventually terminating in alveoli (fig. 4). Cowie & Folley (submitted for publication) have devised a system of scoring from whole mounts in rats by which each kind and degree of mammary development may be assessed. All the glands from individual rats were estimated with regard to arborescence of the duct-system, the presence of club-shaped end-buds, side-buds, and alveolar development. The slides from all rats of one sex (in a particular experiment) were randomized, and scored by the two authors independently. The score was then subjected to an analysis of variance.

The problem of measuring the development of a fully lactating gland, for instance in large domestic animals, is rather more difficult. The data relating to milk-yield have usually been given in combination with a qualitative appraisal of the development of the gland as seen in small sample blocks taken at random. What is required in experiments involving, for instance, the artificial growth of a lactating udder in a virgin animal, is some more accurate method of estimating the amount of functional alveolar tissue, and the proportion which is incompletely or abnormally developed, together with some volumetric measurement of the gland- and teat-cisterns. It is suggested that fixation of the udder by vascular perfusion, when it is in a state of full distension with stored milk, followed by preparation of thick (100  $\mu$ ) collodion sections, will assist in providing this information. It is most desirable with experimental material of this kind to be able to relate the performance of a gland with quantitative measurements such as the average size of alveoli, and the total amounts of glandular tissue and stroma.

### 8. Connective-tissue Stroma of the Mammary Gland

How far the varying textures and growth-behaviour of the connective-tissue stroma of the mammary area may influence the extent of arborization of a growing gland is at present unknown. There are marked variations in the proportions of fibres, cells, and intercellular matrix in this stroma, and these are particularly evident in the human breast (fig. 6) and the udders of domestic animals. It is fairly certain that the development of adipose tissue in the form of lobules mimics to some extent the lobular growth of the gland. Turner (1931) emphasizes the importance of the fatty pad or cushion, present in the udder of the foetal female calf, responsible until pregnancy for the greater part of its volume. This pad is absent in the male goat (Turner, 1936), as well as the steer, which may account, partly at least, for the failure of Folley, Scott Watson & Bottomley (1941), and Folley & Malpress (1945, unpublished observations) to induce normal udder-development by hormonal treatment in the males of these two species.

When the duct-tissue has ramified sufficiently through the stroma to establish the pattern of future lobules, it is well known that the connective tissue immediately adjacent to the ducts becomes more cellular and less fibrous than the interlobular areas (fig. 6). There is an increase in the intercellular matrix, often described as a mucinoid change. Somewhat similar, though not identical, changes in connective tissue have been described in other regions of the body influenced by sex hormones. Thus the erection of the cock's comb, so dependent on male hormone, is

associated with a deposition of mucoprotein in the intercellular spaces (see Hardesty, 1931). Aykroyd & Zuckerman (1938) found that the swelling of the sexual skin in monkeys, following oestrogen stimulation, was due to a transference of water, supplemented by increases in mucoprotein, which they ascribed to the discharge of granules from connective-tissue mast-cells. A remarkably localized transformation of connective tissue in response to sex-hormone administration is described by Heringa & de Jongh (1934) as occurring around the ampulla of the vas deferens in castrated mice treated daily with oestrogen. In this case, the connective tissue underwent a mucoid change closely resembling that in the intralobular areas of the mammary gland.

### 9. Mechanism of Expulsion of Milk

Finally, we must turn our attention to the general problem as to how milk is expelled from a lactating gland. The mere mechanical effect of suckling, or the manipulation of the teat and udder in milking, will not remove all the milk stored in the alveoli and ducts. Capillary attraction in the finer ducts and alveoli restricts the movement of the secretion and, when suction is applied, there is a resistance to withdrawal of milk owing to a valve-like collapse of the larger ducts. Some contractile force, closely associated with the alveoli, appears to be necessary to shift the milk towards the larger ducts or cisterns. It is a mechanism of this kind which is prominent in the phenomenon of "let-down" so well-known in bovines. The forcible extrusion of milk which follows the injection of posterior-pituitary extracts reveals a powerful response of some kind of contractile tissue.

In the salivary glands, which have been investigated with greater precision, it is possible to distinguish several factors influencing the expulsion of the secretion:—secretory nerves ending directly on the glandular cells, alterations in blood-flow, and internal pressure-changes which seem to take origin in some contractile tissue like smooth muscle. Babkin (1944) discusses how each separate mechanism has been examined experimentally in animals. The less-complex mammary gland does not appear to possess secretory nerves directly affecting the rate of synthesis and discharge of the milk-components from its cells. We are left with the possible alternatives that either an erectile effect is produced by vascular engorgement, which squeezes the glandular tissues, or that some contractile tissue exists which on the one hand compresses the alveoli, and on the other shortens the ducts and keeps them open. As the available experimental evidence (see Folley 1947b)<sup>3</sup> favours the second alternative we must examine the distribution of contractile tissues in the mammary stroma.

Smooth muscle is easily identified in all forms in association with the teat or nipple, where circular fibres act as sphincters, and longitudinal or oblique fibres appear to assist in dilating the ducts. Similar but less-regular muscular bundles extend through the walls of the gland-cistern, if present, and then gradually the smooth-muscle fibres decrease as they are traced along the principal branches of the duct-system. Scattered smooth muscle is mingled with the connective tissue and vessels of the interlobular septa in some forms (fig. 7). A closer relationship between

<sup>3</sup> [BMB 1101]



the alveoli and true smooth muscle is seldom found. Thus, the impression is gained that the distribution of smooth muscle subserves an effective control of the duct-system, but it is unlikely to account for contraction of alveoli, if this really occurs.

In a classical paper on the relations of the mammary- and sweat-glands, Benda (1894) described the existence of flattened (myo-epithelial) cells lying between the epithelium and basement-membranes of both these glands. He considered these cells to be contractile in function. Cells, similar in origin and presumably in function, were described in the salivary glands, where they are often called basket-cells, being star-shaped with processes which envelop the external surface of the acini. Unfortunately, these cells are difficult to stain completely and selectively. Their innervation, if any, is obscure. They appear to be numerous around the larger mammary ducts, and have been observed by Kuzma (1943) to undergo hyperplasia in the human breast. Whether they are present immediately outside the alveolar epithelium in all species is still open to doubt. Dieckmann (1925) and Hammond (1927) have contended that the cells, identified by other authors as myo-epithelium in the mammary gland, are in fact adventitial cells belonging to the closely adjacent blood-capillaries.

A further attempt to affirm the existence of these cells in mammary alveoli has been made more recently by Swanson & Turner (1941). Histologists familiar with the work of

Zimmerman (1927) and with the photomicrograph of a salivary basket-cell illustrated by Babkin (1944) may have some hesitation in accepting the evidence given by Swanson & Turner, especially as these authors use the term smooth muscle to cover cells in contact with the epithelium, as well as those mingled with the connective tissue of the stroma. It would be pedantic to stress the independence of these cells, were it not that the evidence for contractility in myo-epithelium is so slender.

Babkin (1944) has assembled experimental evidence from various sources which seems to indicate that the contractile tissue in salivary glands is unlike smooth muscle in its pharmacological responses. Although vasodilation, with sudden filling of the capillary vessels, might conceivably press out the saliva from the acini, the "expressor" effect of histamine, for instance, cannot be correlated sufficiently clearly with its dilating effect on the blood-vessels. By a process of elimination, Babkin comes to the conclusion that the only contractile cells remaining in salivary glands, whose activity might be involved in such phenomena as augmented sympathetic-after-chorda secretion, are the myo-epithelial or basket-cells. May we end by quoting Babkin's own words? "Unfortunately there is no direct evidence of their ability to contract. Further investigation of this problem is very desirable, and will afford an excellent opportunity for co-operation between physiologists and histologists."

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# ENDOCRINE CONTROL OF THE MAMMARY GLAND

## I. Mammary Development

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- 1 Ovarian hormones
- 2 Anterior pituitary
- 3 Adrenal cortex
- 4 Placenta
- 5 Thyroid
- 6 Conclusions
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The outstanding fact regarding the nature of the factors immediately controlling mammary development became apparent many years ago. This was the recognition that mammary growth is under the control of hormonal rather than nervous stimuli. Transplantation-experiments, of which a comparatively modern example is that of Stricker (1929), were perhaps the most decisive in establishing this conception. For an account of early work in this field, and of the normal development of the mammary gland, the reader is referred to Turner (1932) and Turner (1939a) respectively.

An important point which has emerged from morphological studies of mammary development during pregnancy is the necessity to distinguish between the growth-phase, which appears to be largely confined to the first half of pregnancy and the secretory phase beginning at mid-pregnancy, which is accompanied by an increase in the size of the mammary gland due, not so much to further growth, as to accumulation of secretion in the glandular tissues. This conception has recently been confirmed by a biochemical study (Folley & Greenbaum, 1947) in which it was shown, by estimation of the milk-content of the rat mammary gland, that the true moist weight of tissue remains sensibly constant from mid-pregnancy until the end of lactation.

### 1. Ovarian Hormones

Earlier work on the endocrine control of mammary development has been reviewed by Nelson (1936), Turner (1939b) and Folley (1940). Readers should consult these articles for further information since only the briefest references to any but modern work will, in general, be possible here. The broad conclusion emerging from this considerable body of work was that while full duct-development could be evoked by treatment with oestrogen alone, such treatment in many species was incapable of causing development of a normal lobule-alveolar system. For full alveolar development, combined treatment with

oestrogen and progesterone was necessary in many species. Nevertheless, species differences in the mammary response to oestrogen alone have become apparent, and in some cases there is evidence that oestrogen alone can develop both duct and alveolar systems. Notably in the guinea-pig, it was soon apparent that very considerable, if not complete, mammary development could be experimentally induced by oestrogen alone, and more recently it has become clear that the same applies to the goat, cow, and perhaps the monkey.

In the goat, experimental development of an udder capable of secreting considerable quantities of milk has been achieved by treatment with oestradiol monobenzoate (de Fremery, 1938) and with synthetic oestrogens (Folley, Scott Watson & Bottomley, 1940, 1941; Lewis & Turner, 1940, 1941, 1942a; Mixner & Turner, 1943; Mixner, Meites & Turner, 1944; Folley, Malpress & Young, 1945). Even more striking results in bovines have been reported by Walker & Stanley (1940, 1941), Reece (1943), Folley & Malpress (1944a, 1944b), Folley, Stewart & Young (1944), Hammond & Day (1944), Parkes & Glover (1944), Day & Hammond (1945), Folley *et al.* (1945), and Spriggs (1945). The abundant yields of milk produced by the treated animals could have been produced only by well-developed lobule-alveolar systems and, though intact animals were used in most of the experiments, positive responses with a spayed heifer (Walker & Stanley, 1940, 1941) and a freemartin (Folley & Malpress, 1944a) testify to the non-essentiality of luteal influence. Mixner & Turner (1943), however, report that, in the goat, oestrogen alone resulted in the development of abnormally large alveoli often characterized by papillomatous outgrowths of the epithelium into the lumen; combined treatment with oestrogen and progesterone gave a more normal histological picture. The hormonal induction of mammary growth in ruminants is considered further in an accompanying article<sup>1</sup> by Malpress (1947).

In the monkey also, oestrogen seems capable of causing alveolar development as well as duct-development, particularly in the female (Gardner & Van Wagenen, 1938; Folley, Guthkelch & Zuckerman, 1939; Gardner, 1941a). Strikingly positive results on a few males (Gardner & Van Wagenen, 1938; Gardner, 1941a) may or may not be significant, since Folley *et al.* (1939) observed gynaeomastia in one of five normal male monkeys.

In considering the significance of such results as those just discussed in respect of the guinea-pig, ruminant and monkey, it must be remembered that progesterone has been isolated from the adrenal cortex (Beall & Reichstein, 1938), so that the possible intervention of extra-ovarian progesterone in experiments carried out with oestrogen alone on males or ovariectomized females has never been wholly excluded.

An interesting point regarding stimulation of mammary growth by oestrogen is the discovery that for optimal development of the duct-system the dosage of oestrogen must be maintained within circumscribed limits. Gardner, Smith & Strong (1935) first reported that in the mouse stunted duct-systems are the consequence of stimulation with excessive oestrogen levels. This finding has since been confirmed in the mouse (Gardner, Smith, Allen & Strong, 1936; Van Heuverswyn, Folley & Gardner, 1939;

<sup>1</sup> [BMB 1105]

and Gardner, 1941a), rat (Astwood, Geschickter & Rausch, 1937), rabbit (Scharf & Lyons, 1941) and monkey (Gardner, 1941a).

It was once believed that progesterone alone was incapable of stimulating mammary growth; that it would evoke alveolar development only in combination with oestrogen, or at any rate, in glands which had previously come under the influence of oestrogen. Gardner & Hill (1936) showed this to be a misconception, when they found that high doses of progesterone would stimulate mammary development in mice not previously or simultaneously treated with oestrogen. Confirmation has since followed in the mouse (Mixner & Turner, 1942a, 1943; Chamorro, 1944), rat (Selye, 1940a, 1940b; Reece & Bivins, 1942; Selye, Borduas & Masson, 1942; Chamorro, 1944), and monkey (Hartman & Speert, 1941). Relatively large doses must be used—of the order of 15 mg. daily in the rat.

From these studies and others, such as those of Scharf & Lyons (1941) and Lyons & McGinty (1941) in the rabbit, and Mixner & Turner (1942a, 1943) in the mouse, in which optimal oestrogen/progesterone ratios for lobule-alveolar development were determined, it is clear, if one adopts the view that progesterone is the primary agent responsible for lobule-alveolar growth, that much less is required in the presence of oestrogen than in its absence. Mixner & Turner (1943) have advanced a theory which, if it is valid, permits an explanation of this apparent "progesterone-sparing" action of oestrogen. They believe that oestrogen causes an increased vascularity and hyperaemia in the mammary stroma associated with a heightened vascular permeability, all of which factors would favour access to the gland tissues of mammary-stimulating hormones (in point of fact, as will be seen in the next section, believed by Mixner & Turner to be special anterior-lobe hormones) and metabolites specially needed by growing tissues.

## 2. Anterior Pituitary

Though certain workers (Corner, 1930; Lyons & Catchpole, 1933) had previously drawn attention to the possibility that the anterior pituitary might be concerned in mammary development, by virtue of claims to have demonstrated mammary growth in response to anterior-pituitary extracts, this idea assumed prominence only when certain workers failed experimentally to stimulate mammary growth in completely hypophysectomized animals by stimuli which would have been expected to be effective had the pituitary been present. Oestrogen alone or combined with progesterone was found to be ineffective in stimulating mammary growth in completely hypophysectomized mice (Gomez, Turner, Gardner & Hill, 1937; Gomez & Turner, 1937; Lacassagne & Chamorro, 1939), rats (Reece, Turner & Hill, 1936; Astwood *et al.* 1937; Gomez & Turner, 1937; Nathanson, Shaw & Franseen, 1939; Reece & Leonard, 1941; Samuels, Reinecke & Petersen, 1941; Leonard & Reece, 1942; Reece & Leatham, 1945) and guinea-pigs (Gomez & Turner, 1936, 1937; Lyons & Pencharz, 1936). Turner and his school were thus led to put forward the "mammo-gen" theory, according to which oestrogens were held to stimulate mammary-duct growth not directly, but indirectly by evoking the secretion by the anterior pituitary of a duct-growth-stimulating hormone, later known as Mammogen I.

In support of this theory, it was shown that mammary growth could be induced in hypophysectomized male guinea-pigs by daily implants of pituitaries from oestrogen-treated rats, but not from untreated controls (Gomez & Turner, 1937; Gomez, Turner & Reece, 1937), and that while mammary-growth-stimulating (mammo-genic) activity was exhibited by extracts of anterior pituitaries from pregnant cows, which should be actively secreting the mammo-genic hormone or hormones, extracts made from pituitaries of non-pregnant cattle were ineffective (Gomez & Turner, 1938).

The postulation of the existence of two mammo-genic hormones, Mammogen I, responsible for evoking growth of the mammary-duct system and secreted by the anterior pituitary under the influence of oestrogen, and Mammogen II, which causes lobule-alveolar growth and is secreted by the anterior lobe in response to stimulation by progesterone, represented the final development of the mammo-gen theory (Lewis & Turner, 1939; Mixner, Lewis & Turner, 1940). Further studies on the second mammo-genic hormone were reported by Mixner & Turner (1943), who describe a method for its assay, using spayed female mice also receiving oestrogen.

Until quite recently, the mammo-gen hypothesis was characterized by a rather surprising feature, namely, the belief (Lewis & Turner, 1938, 1939; Gomez, 1942; Lewis, Gomez & Turner, 1942) that Mammogen I was, unlike the well-characterized anterior-pituitary hormones which all appear to be proteins, soluble in organic solvents. Greep & Stavely (1941) were, however, unable to confirm this claim, which has since been withdrawn (Trentin, Lewis, Bergman & Turner, 1943). This Missouri group now finds that mammo-genic activity resides in the protein fraction.

In any assessment of the present status of this interesting hypothesis, a number of discordant results must be taken into account. In the first place, positive mammary-growth responses to various steroids in completely hypophysectomized animals have been reported (Asdell, Brooks, Salisbury & Seidenstein, 1936; Fredrikson, 1939; Gardner, 1940, 1941b; Gardner & White, 1942; Leonard, 1943; Smithcors & Leonard, 1943), though in most cases the amount of growth was limited. Further, some authors (Nelson, 1938, 1939; Reece & Leonard, 1939) have been unable to confirm the claim that pituitaries from oestrogenized donors contain more mammo-gen than those from controls.

Perhaps the most serious objection may be based on the results of experiments in which it was found that percutaneous application of minimal, or near-minimal, doses of oestrogen to one rudimentary mammary gland will cause development of the treated rudiment, while neighbouring glands show either no effect or grow to a much smaller degree (see MacBryde, 1939, for woman; Lyons & Sako, 1940, rabbit; Nelson, 1941a, guinea-pig; Gardner & Chamberlin, 1941, mouse; Speert, 1940a, and Chamberlin, Gardner & Allen, 1941, monkey). These results, which should not be confused, as Petersen (1944) seems to have done, with generalized mammary development in ruminants (Folley *et al.* 1940, 1941) evoked by innunction of the perithelial skin with doses of oestrogen probably sufficient to cause systemic effects, at first sight would appear to provide conclusive evidence of the direct action of sex hormones on the mammary gland, since if

this action were indirect via the anterior pituitary, the action would in fact be systemic, resulting in equal growth in all glands. Mixner & Turner (1943) have, however, attempted an ingenious explanation of these findings in terms of the mammogen theory. They suggest that the action of the percutaneously-applied oestrogen causes localized hyperaemia of the mammary stroma, resulting in an increased and effective supply of mammogenic hormones already circulating in sub-threshold concentration. However, attempts to evoke localized mammary growth by percutaneous application of a rubefacient such as turpentine, alone or combined with oestrogen given systemically (Mixner & Turner, 1941; Lewis & Turner, 1942b), hardly afforded convincing support for this explanation.

The foregoing discussion, necessarily condensed but, it is hoped, adequately covering the main points, reveals a rather confused situation regarding the role of the anterior pituitary in mammary development. Further work is clearly needed to clarify this picture. The experiments on localized mammary growth and the results of those workers who have demonstrated even slight mammary-growth responses to steroids in completely hypophysectomized animals together make a case for the direct action of ovarian hormones on the mammary tissues which, in the writer's opinion, has not yet been overturned. That the co-operation of the anterior pituitary (or of some other organ such as the placenta which, as will be seen in a following section, may be capable of substituting for some function of the anterior pituitary) may be necessary for the full expression of this action is indicated by the experiments of Leonard & Reece (1942), who could not obtain localized mammary responses to oestrogen in hypophysectomized animals, and by the fact that in the experiments in which mammary growth has been evoked by systemic injection of steroids the responses have usually been slight. This, however, does not affect the point at issue.

On the other hand, few would deny the validity of the evidence which suggests that crude anterior-pituitary extracts contain factors capable of promoting mammary growth in gonadectomized and even hypophysectomized animals. In addition to the Missouri group, other workers (e.g. Greep & Staveland, 1941 and Cowie & Folley, 1944, 1947) have found that anterior-pituitary extracts will promote mammary growth in gonadectomized animals. The point of uncertainty is whether these effects are due to new anterior-pituitary hormones Mammogens I and II, or whether they may be ascribed to one or other of the well-characterized hormones known to be secreted by the anterior lobe. On this point, Mixner, Bergman & Turner (1942) believe that the lobule-alveolar growth-promoting mammogen is distinct from prolactin, thyrotrophin and gonadotrophin.

There is indeed some reason to believe that of the known anterior-lobe hormones, prolactin (anterior-pituitary lactogenic hormone) may be the one most likely to be concerned with mammary growth. Lyons & Catchpole (1933) claimed that prolactin would promote growth of the mammary tissue, and more convincing evidence has since been provided by Lyons (1942), who reported localized alveolar hyperplasia in response to intra-mammary-duct injections of pure prolactin in the rabbit. Moreover, fairly extensive mammary growth in hypophysectomized

animals in response to combined treatment with oestrogen and prolactin has been reported (Gardner & White, 1941, 1942; Gomez, 1942; Lyons, 1943). Gardner & White have indeed put forward the view that prolactin sensitizes the mammary gland to the action of ovarian hormones, a theory which, implying as it does a synergism between anterior-pituitary hormones and ovarian steroids, without excluding a direct action of the latter on the mammary epithelium, has something to commend it.

### 3. Adrenal Cortex<sup>2</sup>

The possibility that the adrenal cortex might influence mammary development was first indicated when Van Heuverswyn, Folley & Gardner (1939) showed that one of the cortical hormones, deoxycorticosterone, would promote growth of the mammary ducts in mice. In general confirmation of the mammogenic effect of deoxycorticosterone, it was later found that this hormone would stimulate alveolar growth in the monkey (Speert, 1940b), guinea-pig (Nelson, Gaunt & Schweizer, 1943) and, in the presence of oestrogen, in the mouse (Mixner & Turner, 1942b, 1943). No observations of the effects of 11-oxygenated cortical steroids on mammary development have yet been made, but the results with the 11-deoxy hormone might well provide an explanation of clinical cases of gynaecomastia associated with tumours of the cortex, and of gynaecomastia following treatment of males with cortical extracts.

On the other hand, the few studies which have been made on the effects of adrenalectomy on mammary-gland structure have given discordant and not very dramatic results. Results which may be interpreted as indicating (but perhaps not decisively) that adrenalectomy is followed by increased mammary growth have been reported by Butcher (1939) and Reeder & Leonard (1944), but Cowie & Folley (1944, 1947) found that, when such mammary changes occurred, they were in the direction of regression.

Since one of the adrenal-cortex hormones is capable of causing mammary growth, the possibility that the mammogenic activity exhibited by crude anterior-pituitary extracts might be due, at any rate partly, to the presence therein of adrenotrophin must be considered, particularly since Nelson (1941b) has observed mammary growth in hypophysectomized-gonadectomized rats following injections of adrenotrophin. Cowie & Folley (1947), using a semi-quantitative method devised by them for statistical study of mammary development in the rat, found that while the mammogenic effect of crude anterior-pituitary extract was often upset by adrenalectomy, it was to a considerable extent independent of the adrenal cortex and hence not by any means wholly ascribable to adrenotrophin.

On the basis of present knowledge then, there is no reason to believe that the cortex exerts any important influence on normal mammary development.

### 4. Placenta

In pregnant mice from which the foetuses and ovaries (Newton & Lits, 1938) or foetuses and hypophysis

<sup>2</sup> Since this review was written papers by Chamorro have come to hand in which it is reported that adrenalectomy had no effect on mammary structure in adult rats (Chamorro, 1946) and that administration of deoxycorticosterone caused, at best, only slight growth-responses in the mammary gland of the castrated male mouse (Chamorro, 1945).

(Newton & Beck, 1939) are experimentally removed, when the placentae are retained until autopsy the mammary glands resemble those characteristic of the pregnant animal at a corresponding stage of gestation. If the placentae are aborted, however, the mammae regress. There is an obvious temptation to interpret these facts as showing that, in the absence of the hypophysis, the placenta is able to promote mammary growth. The fact that in species which do not abort following hypophysectomy during pregnancy the mammae appear fairly normal at term, sometimes even to the extent of secreting milk for a short time (see Selye, Collip & Thomson, 1933b; Newton & Beck, 1939; Newton & Richardson, 1941; Gardner & Allen, 1942, for the mouse; Selye, Collip & Thomson, 1933a; Pencharz & Long, 1933; Jeffers, 1935, rat; and Pencharz & Lyons, 1934; Desclin, 1939, guinea-pig), has suggested to some that in these circumstances the placenta may take over the function of the missing hypophysis as far as it is concerned with mammary growth and the initiation of milk-secretion.

Lyons (1944) has recently reported results which suggested to him that the placenta may secrete a hormone which synergizes with ovarian hormones in causing mammary growth. In rats hypophysectomized early in pregnancy, oestrone and progesterone caused continued mammary development only in the presence of the placenta. A somewhat similar conclusion was reached by Leonard (1945).

The majority of the above-mentioned workers seems, however, to have neglected the distinction, emphasized at the beginning of this review, between the mammary-growth phase largely confined to the first half of pregnancy and the secretory phase (accompanied by an apparent, but probably not real, increase in alveolar tissue) characteristic of the second half of pregnancy. It seems likely that, in the absence of the hypophysis, the placenta may assume an hypophyseal function in that it secretes a hormone or hormones capable of initiating the secretory phase and thus preventing mammary regression. But this is hardly the same thing as promoting mammary growth, and the whole question of placental influence on mammary development obviously needs further investigation with this point in mind.

### 5. Thyroid

Observations of earlier workers on reproduction in thyroidectomized rats and mice suggest that mammary growth can occur in the absence of the thyroid, but these studies were of such a nature that they could not, nor were they intended to, provide detailed information on the structure of the mammary gland. More-recent studies, directed specifically to this end, such as those of Leonard

& Reece (1941), Smithcors & Leonard (1942), Mixner & Turner (1942c, 1943), and Chamorro (1946) (see also Petersen, Knodt, Ludwick & Pomeroy, 1944), suggest that thyroidectomy exerts a profound influence on mammary development, most probably by modifying the response of the mammary tissue to the stimulus of hormones which promote mammary growth. Thus, in the absence of the thyroid, oestradiol appears to promote alveolar growth rather than duct-growth in the rat (Smithcors & Leonard, 1942). In considering many of these results, the great difficulty, if not virtual impossibility, of achieving complete thyroid removal, at any rate in the rat (Folley, Scott Watson & Amoroso, 1942; Karnofsky, 1942), must not be overlooked.

Experiments on the effect on mammary growth of thyroid administration (Weichert & Boyd, 1934; Cohen, 1935; Gardner, 1942; Mixner & Turner, 1942c, 1943) also indicate that, in keeping with the role of the thyroid gland as a regulator of body metabolism, the level of thyroid activity exerts an indirect influence on mammary development in the manner postulated above. The indirect nature of this influence is underlined by Gardner's (1942) finding that thyroid-feeding accelerated mammary growth in intact, but not in gonadectomized, mice.

### 6. Conclusions

In this necessarily brief review it has been possible to consider only certain aspects of the general problem of mammary growth; even within these limits, citation and discussion of many important papers have had to be omitted. Nevertheless, the considerations that have been put forward permit certain broad conclusions. The ovarian hormones, oestrogen and progesterone, are undoubtedly the principal primary agents which evoke mammary growth. Whether or not they accomplish this through the agency of specific anterior-pituitary mammogens remains to be seen, but it does seem established that the anterior pituitary may secrete factors which can cause mammary development in the absence of both the ovaries and adrenals, and pituitary influence may well be essential for the complete expression of the mammary-growth-stimulating action of oestrogen and progesterone. The influence of the thyroid on mammary development is probably indirect; that of the placenta problematical.

In most, perhaps all, species, both oestrogen and progesterone, presumably in a well-adjusted ratio, are necessary for complete and normal mammary development, but in certain species oestrogen alone evokes development of a considerable amount of alveolar tissue, which however is not necessarily normal structurally. This can be accomplished most spectacularly in the ruminant, in which results of potential practical significance have been obtained.

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## ENDOCRINE CONTROL OF THE MAMMARY GLAND

### II. Lactation

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- 1 Anterior-pituitary lactogenic hormone (prolactin)
- 2 Prolactin as a specific lactogenic hormone
- 3 Galactopoietic action of the anterior pituitary
- 4 Suckling-stimulus and prolactin secretion
- 5 Oestrogen
- 6 Adrenal cortex
- 7 Thyroid
- 8 Posterior pituitary
- 9 Initiation of lactation
- References

Modern developments in the field of lactational endocrinology date from the discovery by Stricker & Grueter (1928) that lactation could be initiated in pseudopregnant rabbits, after ovariectomy, by injection of anterior-pituitary extracts. This important discovery, which carried the then novel implication that the intervention of a positive hormonal stimulus is necessary for the initiation of lactation, was quickly confirmed in its essentials in a variety of species, the only desideratum being the presence in the test-animal of a sufficiency of responsive mammary tissue. The crucial importance of the pituitary for mammary secretion was also soon demonstrated by numerous experiments in which it was shown that its absence was incompatible with the initiation or maintenance of lactation (see reviews by Nelson, 1936; Turner, 1939; and Folley, 1940).

#### 1. Anterior-Pituitary Lactogenic Hormone (Prolactin)<sup>1</sup>

Evidence was soon forthcoming which suggested that the lactogenic properties of anterior-pituitary extracts were not associated with the three, perhaps four, anterior-pituitary hormones—growth hormone, thyrotrophic hormone and the one or two gonadotrophic hormones—which at the time were emerging as fairly well-characterized entities, and the idea arose that a new hormone (lactogenic hormone or prolactin) was responsible.

The chemical studies leading to the recognition of the existence of this new hormone were greatly aided by its

early identification by Riddle, Bates & Dykshorn (1933) with a constituent of anterior-pituitary extracts which causes enlargement and secretion of the crop-glands of the dove and pigeon. This interesting discovery provided the basis for a convenient and apparently specific quantitative method of assay of prolactin. The assay method described by Riddle *et al.* (1933) and adopted with minor modifications by several subsequent workers, involved systemic injection and weighing of the crop-glands. A "micro" or "local" method, in which the test-solution is injected intradermally directly over the crop-gland, and which enables the detection and even quantitative measurement of much smaller amounts of hormone than can be assayed by the systemic method, was introduced by Lyons & Page (1935) for the assay of prolactin in urine, and the principle was used in various forms by subsequent workers for, among other purposes, determining the prolactin potency of pituitaries of small animals (for references to clinical studies of prolactin excretion, see Meites & Turner, 1941). Attempts have been made to develop mammalian methods of prolactin assay, which would obviously be preferable from the theoretical point of view, but, judging from the fact that pigeon-methods still hold the field, so far without conspicuous success. Review articles on the assay of prolactin have been published by Bates (1937), Lyons (1937) and Riddle & Bates (1939), and the interested reader might also consult Bergman, Meites & Turner (1940), Folley, Dyer & Coward (1940), Meites, Bergman & Turner (1941), Lyons (1941) and Hall (1944a, 1944b) for details regarding various methods of prolactin assay, quantitative comparisons between various types of unit and other practical information.

Two useful methods for partial purification and concentration of prolactin, respectively involving extraction of pituitary glands with acid acetone (Lyons & Catchpole, 1933) and alkaline alcohol (Bates & Riddle, 1935), were evolved at an early stage, but more recently it has been possible to prepare prolactin as a pure amorphous (Li, Simpson & Evans, 1942) and even crystalline (White, Catchpole & Long, 1937; White, Bonsnes & Long, 1942) protein, exhibiting an activity of 20-30 international units per mg. Prolactin was the first anterior-pituitary hormone to be isolated in the pure state, and recently considerable information concerning its chemistry has accrued from the studies of groups led by Evans at California and White at Yale. For further information on chemical aspects the reader should consult recent excellent reviews by White (1943, 1946) and, for a general account of prolactin, a comprehensive review by Voss (1941).

#### 2. Prolactin as a Specific Lactogenic Hormone

The remarkable ability of anterior-pituitary extracts containing, as judged by the pigeon crop-gland test, prolactin, to initiate lactation in animals possessing suitable mammary tissue, a property which, it was soon manifest, could be enhanced by chemical purification, gave rise to the current belief, widely held, that prolactin is the sole and specific lactogenic hormone. In other words, most workers in this field (*e.g.* Bergman & Turner, 1940; Lyons, 1941) at present adhere to a theory which postulates a single anterior-pituitary hormone, prolactin, as being responsible

<sup>1</sup> For a few years after its discovery this hormone was variously called *prolactin* (Riddle), *galactin* (Turner) and *mammotropin* (Lyons). Later, the terms *lactogen* and *lactogenic hormone* were introduced, and the latter is now widely used in the USA. In this review, *prolactin*, the term which is customarily used in Britain, will be adopted.



for the initiation of lactation. At the same time it has been recognized that participation in lactogenesis may not be the only, nor necessarily the most important, biological function of prolactin (e.g. Riddle & Bates, 1939).

We must take note, however, of the modern tendency to define the specific biological properties of anterior-lobe hormones in terms of the responses evoked in hypophysectomized animals, the argument being that in intact animals the intervention of endogenous pituitary hormones may obscure the response-picture. If, in keeping with this conception, lactogenic hormones are defined as anterior-pituitary hormones which will initiate lactation in *hypophysectomized* animals possessing suitably-responsive mammary tissue, there is reason to doubt the adequacy of the single-lactogenic-hormone theory. For, while crude anterior-pituitary extracts will initiate lactation in the absence of the hypophysis (McPhail, 1935a, 1935b; Houssay, 1935a; Gomez & Turner, 1936a, 1937a; Nelson & Gaunt, 1936, 1937a), partially-purified prolactin is ineffective (Gomez & Turner, 1936a, 1937a; Nelson & Gaunt, 1936, 1937b). Evidently some other anterior-lobe hormone or hormones, missing from the partially-purified prolactin-preparations, must co-operate with prolactin in initiating lactation in hypophysectomized animals, and it happens that adrenotrophin may be specially important in this connexion, since lactation can be initiated in hypophysectomized guinea-pigs by administration of partially-purified prolactin (and sometimes glucose) together with adrenal-cortex extract (Gomez & Turner, 1936b, 1937a; Nelson & Gaunt, 1936, 1937a, 1937b), certain cortical steroids (Nelson, Gaunt & Schweizer, 1943) or adrenotrophin (Gomez & Turner, 1937a, 1937b; Nelson & Gaunt, 1937b).

Two points are worth noting about these results. First, they relate only to the guinea-pig, an animal in which it is particularly easy to stimulate lactogenesis (see Nelson, 1936), so that its lack of response to partially-purified prolactin is the more remarkable. Second, Fredrikson (1939) has reported positive lactational responses to purified prolactin in completely hypophysectomized rabbits, so that it seems desirable that the above-mentioned experiments should be repeated on other species, preferably with the highly-purified pituitary-hormone preparations now available. But if they are acceptable, then as Folley & Young (1941) in a discussion of the status of prolactin as a lactogenic hormone have pointed out, the results just discussed can mean only that prolactin and adrenotrophin must both be considered as lactogenic hormones, for either will presumably initiate lactation in the presence of the other. Thus, in place of the conventional single-lactogenic-hormone theory, Folley & Young (1938, 1940, 1941) put forward the conception of a lactogenic hormone-complex, a view in which Riddle (1940) apparently concurs. Two members of this hormone-complex appear to have been identified as we have seen, while others may or may not remain to be discovered. The fact that in lactogenesis prolactin may exert a direct action on the mammary gland, as indicated by the elegant experiments of Lyons (1942) who demonstrated a direct and localized effect of prolactin on the alveolar epithelium, while adrenotrophin almost certainly plays an indirect role in that perhaps it governs, through the cortical hormones, the supply of milk-precursors (see section on Adrenal Cortex, below), does nothing to invalidate the above argument.

As evidence for the existence of a single specific lactogenic hormone, prolactin, Bergman, Meites & Turner (1940) cite results of prolactin assays carried out on pigeons and mammals with an anterior-pituitary extract at different stages of purification. The ratio of the potencies given by the two types of assay was hardly affected by purification. This might merely mean, however, that the components of a lactogenic hormone-complex were concentrated in the same proportions. Further, Bergman & Turner (1940) have pointed out that an anterior-pituitary extract can be fractionated into two parts, one containing the prolactin and possessing high lactogenic activity in intact mammals, the other containing certain other anterior-lobe hormones and exhibiting very little lactogenic activity even in comparatively large doses. For discussion of these results in relation to the single- and multiple-lactogenic-hormone theories, the reader is referred to Folley & Young (1941); it suffices to point out now, that since the experiments of Bergman & Turner relate to rabbits possessing pituitary glands, they are hardly relevant to the point at issue. More recently Hurst & Turner (1942) appear to accept the view that more than one anterior-pituitary hormone may be concerned in lactogenesis, at least in the mouse.

### 3. Galactopoietic Action of the Anterior Pituitary

In the present state of knowledge it seems desirable to use separate terms in respect of the initiation of lactation and its stimulation once established. Following Folley & Young (1940) and Bergman & Turner (1940), the terms "*lactogenesis*" and "*galactopoiesis*" are used in this review to designate these two processes respectively.

Investigations on lactating ruminants have clearly shown that anterior-pituitary extracts exert a marked but temporary galactopoietic effect, the important point being that unfractionated extracts are much more active per unit of prolactin than preparations of purified prolactin, both when responses to single injections (Azimov & Krouze, 1937; Folley & Young, 1938) or repeated injections (Folley & Young, 1940) are measured. Studies of the galactopoietic activities of anterior-pituitary extracts in relation to certain of their other biological properties (Folley & Young, 1938, 1939, 1940) indicated some parallelism between the galactopoietic and glycotropic (anti-insulin) activities of the series of extracts used, so that a complex of anterior-pituitary factors (one member of which is, of course, prolactin) rather than a single hormone would appear to be involved in the maintenance of lactation as well as in its initiation.

Galactopoiesis is discussed in another paper<sup>2</sup> of this series (Young, 1947), to which the reader is referred, and it remains only to consider briefly the bearing of this question on the clinical use of prolactin. Prolactin has been used for the treatment of hypogalactia (for reviews see Riddle, 1940; Robinson,<sup>3</sup> 1947; and Voss, 1941) with conflicting and often disappointing results. Quite apart from the fact that hypogalactia may not necessarily be due to anterior-pituitary hypofunction, such a lack of agreement might be expected from the considerations briefly outlined above, since the extracts used have been standardized in terms of prolactin content as measured by the pigeon-method and used on the tacit assumption that this is a measure of

<sup>2</sup> [BMB 1104]  
<sup>3</sup> [BMB 1106]

galactopoietic power. As the investigations of Folley & Young show, this is certainly not the case.

#### 4. Suckling-Stimulus and Prolactin Secretion

Though no one today believes in the existence of secretory nerve-fibres passing to the mammary gland, it has been suggested that nervous influences may be concerned in the secretion of milk by remote control, as it were, in so far as the release of prolactin from the pituitary may to some extent depend on nervous stimuli.

Selye, Collip & Thomson (1934) give a full discussion of this question, which was opened by such observations as those of Selye (1934), who found that in lactating rats in which some nipples at least were suckled, the histological picture of cessation of secretory activity and involution, characteristic of weaning, was absent from glands from which egress of milk was prevented by duct-ligation, or of which suckling was rendered impossible by excision of the nipple. Their interpretation ascribes these effects to reflex secretion of prolactin, acting systemically on all glands alike, in response to the suckling-stimulus. These results have in broad outline been confirmed by Williams (1941).

Other results in general accord with such an interpretation have been reported. Thus, mammary involution in non-suckled glands can be retarded by utilizing the irritant action of turpentine, applied to the nipples, as a substitute for the suckling-stimulus (Hooker & Williams, 1940), or by injections of prolactin (Hooker & Williams, 1941). If one accepts the view that the pituitary-prolactin potency is a measure of prolactin secretion, the results of Meites & Turner (1942a, 1942d) could also be cited. They found more prolactin in the hypophyses of suckled rats and rabbits than in those of non-suckled ones. Finally, we have the observations of Selye & McKeown (1934a, 1934b), who showed that pseudopregnancy (accompanied by mammary development) could be induced in cyclic rats and mice by application of the suckling-stimulus, but only in the presence of the ovary. These last observations fit into the general picture, provided that we accept the luteotrophic role for prolactin (e.g. Evans, Simpson & Lyons, 1941; Astwood, 1941), evidence for which is growing.

#### 5. Oestrogen

Dating from the experiments of Parkes & Bellerby (1927), who showed that administration of oestrogen to lactating mice depressed the growth-rate of the sucklings, numerous experiments on small animals, in which lactational performance can be measured only by a similar indirect technique, have been held to testify that oestrogen exerts an inhibitory action on lactation. These experiments are referred to in reviews by Nelson (1936), Turner (1939), Folley (1940) and Petersen (1944), and are discussed in papers by Folley & Kon (1937), Edelmann & Gaunt (1941) and Meites & Turner (1942a).

Doubts as to the reality of the apparent inhibiting action of oestrogen on lactation have been expressed, notably by Abarbanel & Goodfriend (1940), who hold that the beneficial results following the administration of oestrogen to lactating women, who for one reason or another must not be allowed to lactate, are due rather

to relief of painful engorgement (a condition ascribed to lymphatic and venous stasis) than to inhibition of milk-secretion, which, it is believed, does not occur in spite of the oestrogen if suckling is continued (see also Fauvet, 1943). Meites & Turner (1942a) also question whether oestrogen inhibits lactation, principally because the administration of oestrogen, even in large doses, causes an increase, not a decrease, in the prolactin content of the pituitary.

However, despite the criticisms that may be levelled against the results with small animals in which lactational performance can be inferred only by an indirect and not unobjectionable technique, experiments on ruminants, in which milk-yield can be directly and accurately measured (Folley, 1936; Waterman, Freud & Vos-de Jongh, 1936; Folley, Scott Watson & Bottomley, 1941a; Stanley & Owen, 1941; Mixner, Meites & Turner, 1944; Folley, Malpress & Young, 1945), appear to provide good evidence that sufficient doses of oestrogen tend to suppress lactation even though milking is continued. The fact that the doses of oestrogen necessary may have been "unphysiological" does not affect the principle at issue.

Besides the possible inhibitory action on lactation just considered, oestrogen, as is now known, is capable of exerting quite opposite effects. In fact, there now exists an impressive body of evidence indicating that under appropriate conditions oestrogen may function both as a lactogenic and a galactopoietic agent.

Even while the opinion that the role of oestrogen in lactation was purely inhibitory was still widely and authoritatively held, certain workers (e.g. Frazier & Mu, 1935) had observed evidence of secretion in the experimentally-developed mammae of small animals subjected to prolonged oestrogen treatment. The most striking and unequivocal evidence of the lactogenic effect of oestrogen has however been obtained in more recent studies on ruminants.

The results of Folley, Scott Watson & Bottomley (1940, 1941b), who surprisingly found that oestrogen would not only evoke udder-growth in the goat, but also the initiation of copious lactation, indicated unequivocally for the first time, as far as the present writer is aware, the necessity for a revision of classical concepts (ably expounded by Nelson, 1936) which assigned to oestrogen the dual role of stimulating mammary development while holding secretion in check. These results were quickly confirmed and extended in the goat (Lewis & Turner, 1940, 1941, 1942; Mixner & Turner, 1943; Folley, Malpress & Young, 1945), sheep (Peeters & Massart, 1947) and ox (Walker & Stanley, 1940, 1941; Reece, 1943; Folley & Malpress, 1944a, 1944b; Folley, Stewart & Young, 1944; Hammond & Day, 1944; Parkes & Glover, 1944; Day & Hammond, 1945; Spriggs, 1945). The whole question is discussed more fully in an accompanying article<sup>4</sup> (Malpress, 1947).

These interesting and even spectacular findings testify to the ability of oestrogen to evoke certainly lactogenesis, and probably also galactopoiesis, since a constant feature was the compatibility of a fast-increasing milk-yield with the continued administration of oestrogen. In point of fact, evidence of a galactopoietic effect of oestrogen had already been obtained by Folley (1936) in experiments of quite a different nature, galactopoiesis manifesting itself

<sup>4</sup> [BMB 1105]

by a prolonged increase in the concentration of milk-solids (the "enrichment" effect). Later investigation of the "enrichment" effect has shown that an increased secretion of major milk-constituents is involved, and that there is no question of the milk-composition reverting towards that of colostrum (Folley & Scott Watson, 1938; Folley, Scott Watson & Bottomley, 1941a; Spielman, Ludwick & Petersen, 1941).

As to the mechanism of these lactogenic and galactopoietic effects, it seems most probable that they are mediated by the anterior pituitary, which must be supposed to release the lactogenic and galactopoietic hormone-complexes (which incidentally, may or may not be identical, but see Folley & Young, 1941) in response to the stimulus of oestrogen or perhaps of metabolic derivatives thereof. Folley (1941) in a discussion of the role of oestrogen in lactation, has suggested that the oestrogen-threshold for pituitary stimulation is probably lower than that for inhibition, so that the factor determining whether stimulation or inhibition shall prevail would be the level of oestrogen in the body-fluids.

## 6. Adrenal Cortex

Experiments on the initiation of lactation in the absence of the hypophysis, discussed above, have emphasized the importance of the pituitary-adrenal mechanism in this connexion and led to the conclusion that the functional integrity of the cortex is essential for lactogenesis. Information on which of the cortical functions is critical for lactogenesis comes from the work of Nelson *et al.* (1943), whose results indicate that the cortical steroids which together with prolactin initiate lactation in hypophysectomized animals are those which promote gluconeogenesis (11-oxygenated steroids) rather than those related to electrolyte metabolism (11-deoxy steroids).

The role of the adrenal cortex in lactation has also been studied in adrenalectomized animals. Early investigations indicated that normal lactation was impossible in the absence of the adrenals (for references see Nelson & Gaunt, 1937a). From more recent work on the rat it is clear that though adrenalectomy seriously interferes with lactation, it does not abolish it completely<sup>5</sup> (Gaunt 1941; Gaunt, Eversole & Kendall, 1942; Folley & Cowie, 1944; Cowie & Folley, 1947a). It also appears that some alleviation of the lactational failure may be afforded by sodium chloride (Gaunt & Tobin, 1936; Levenstein, 1937; Folley & Cowie, 1944; but see Tobin, 1939) and more by administration of cortical extracts (Gaunt & Tobin, 1936; Gaunt *et al.* 1942; but see Folley & Cowie, 1944).

Investigations of the ability of various crystalline cortical steroids to maintain lactation in adrenalectomized rats have, however, given rise to a rather puzzling situation. Gaunt *et al.* (1942) achieved only partial and irregular lactational responses with 11-deoxycorticosterone, but complete restoration with 17-hydroxy-11-dehydrocorticosterone, and were thus led to conclude that while the restoration of a normal electrolyte metabolism may be helpful for the maintenance of lactation, the limiting factor for maximal secretion is a sufficiency of those

cortical factors (the 11-oxygenated steroids) which are concerned with carbohydrate and protein metabolism. Folley & Cowie (1944), however, found that the 11-oxygenated steroids were inferior to 11-deoxycorticosterone for lactation-maintenance in their rats, and further studies have shown that the relative activities in this respect of the two types of steroid were unaffected by increasing the intake of protein (Cowie & Folley, 1947b) or sodium (Cowie, Folley, French & Greenbaum, 1947). Save in one exceptional experiment, however, (Cowie & Folley, 1947a), it has not been possible to achieve complete restoration of lactation in adrenalectomized rats with 11-deoxycorticosterone.

In a study of the arginase (an enzyme concerned in the formation of urea, and therefore a participant in gluconeogenesis) of the mammary gland, Folley & Greenbaum (1947a) were led to suggest that gluconeogenesis is an important element in the metabolism of the fully-lactating gland. Now, adrenalectomy appears to result in a decrease in the arginase not only of the liver (Fraenkel-Conrat, Simpson & Evans, 1943; Folley & Greenbaum, 1946) but also of the mammary gland (Folley & Greenbaum, 1946; Cowie *et al.* 1947), and it seems possible therefore that the impairment of lactation following adrenalectomy may be due, at least partly, to the loss of milk precursors which arise from the deamination of amino-acids in the mammary tissue<sup>6</sup>.

Finally, brief consideration must be given to the possibility of the existence of a specific lactation-hormone of the adrenal cortex. The presence of such a hormone, called cortilactin, in adrenal-cortex extracts was postulated by Brownell, Lockwood & Hartman (1933) (see also Hartman, Lockwood & Brownell, 1933). Spoor, Hartman & Brownell (1941) claim that cortilactin is a pigeon-crop-stimulating hormone which plays no role in gluconeogenesis, but Hurst, Meites & Turner (1942) could detect no crop-stimulating activity in adrenal-cortex extracts. In view of the above-mentioned claims to have effected complete restoration of lactation in adrenalectomized rats with crystalline steroids, the existence of cortilactin must, until further evidence is forthcoming, be treated with reserve.

## 7. Thyroid

Experiments on the effect of thyroidectomy on lactation in various species have given no very clear picture. Interpretation of the results is complicated in the case of farm-animals by the effects of operative disturbances, which have been recognized by such workers as Grimmer (1918) and Graham (1934a), and in the case of the rat by the difficulty of effecting complete thyroid removal, and by the fact that the operation must involve the removal of the parathyroids (see Folley, Scott Watson & Amoroso, 1942; Cowie & Folley, 1945). There is no space to consider these studies here, but they have been briefly reviewed by Turner (1939), Folley (1940) and Petersen (1944). A critical appraisal leads to the general conclusion that in the absence of the thyroid, lactation can be initiated (on this specific point, also see Houssay, 1935b), and will proceed, but only at a reduced level and perhaps for a shorter time than normally.

<sup>5</sup> Recent paired-feeding experiments in the present author's laboratory indicate that part, but not all, of the lactational decline following adrenalectomy may be ascribed to the reduction of food-intake resulting from the operation (Cowie & Folley; to be published).

<sup>6</sup> The decrease in liver and mammary gland arginase levels following adrenalectomy does not appear to be due to a non-specific operation, since these changes have been obtained in paired-feeding experiments (Folley & Greenbaum, 1947b).

Studies of the effects on milk-yield of administration of thyroid hormone lead to the conclusion, which is in harmony with the role of the thyroid as a regulator of body-metabolism, that the intensity of lactation is to some extent dependent on the general level of activity of the thyroid gland. A temporary galactopoietic response following the administration of dried thyroid to one cow was reported as long ago as 1896 by Hertoghe (1896), but modern work on the galactopoietic effect of the thyroid hormone was initiated by Graham (1934a, 1934b), who observed marked increases in the yield of milk, and even greater increases in the yield of milk-fat, during the administration of dried thyroid gland, or thyroxine, to cows in declining lactation. The first adequate confirmation and extension of these results came from Folley & White (1936), who showed that thyroxine treatment does not hold up the normal decline of lactation, but merely raises the lactation-curve, temporarily, to a higher level, and that in addition to the increase in fat-content the non-fatty solids of the milk are also increased. They also found that thyroxine administration causes an immediate and dramatic decline in the concentration of alkaline phosphatase in the milk.

Further investigations of these galactopoietic responses have further defined their principal features (Herman, Graham & Turner, 1938; Hurst, Reece & Bartlett, 1940; Ralston, Cowser, Ragsdale, Herman & Turner, 1940; Smith & Dastur, 1938) and essentially-similar results have been obtained by oral administration of iodocasein, a protein derivative which exhibits thyroidal activity, to lactating cows (Reineke & Turner, 1942a, 1942b; Blaxter, 1943, 1945a, 1945b, 1946; Reece, 1944; Van Landingham, Henderson & Weakley, 1944). These galactopoietic effects, advantage of which may well soon be taken in farm-practice, are dealt with further in an accompanying article<sup>7</sup> (Young, 1947).

### 8. Posterior Pituitary

Extracts of posterior pituitary exert a rapid but fleeting action on the mammary gland. Within a few seconds of the intravenous injection, shortly before her normal milking-time, of posterior-pituitary extract into a lactating cow or goat, there is a sudden, marked increase in the pressure of milk in the udder-cisterns, with which is associated the possibility of obtaining somewhat more milk than would be expected on the basis of previous milkings. If the injection is given to a lactating animal with a cannulated teat, its effect is quickly manifested by a temporary increase in the flow of milk from the cannula.

This response to posterior-pituitary extract was discovered by Ott & Scott (1911) and subsequent study of it (see references cited by Turner & Slaughter, 1930; Ely & Petersen, 1941; and Petersen, 1944) has corrected the early impression that true galactopoiesis was involved. In order to understand the nature of the effect of posterior-lobe extract on the mammary gland it is necessary to appreciate the distinction between two quite separate phenomena, the secretion of milk (which itself may be regarded as comprising two sub-phenomena, the synthesis of milk and its passage from the cytoplasm of the epithelial cells into the alveolar lumen) and the discharge or withdrawal of pre-formed milk

from the mammary gland (see accompanying article<sup>8</sup> by Folley, 1947). Consideration of all the available evidence leaves little room for doubt that posterior-pituitary extracts have no effect upon the secretion of milk (not at any rate primarily) but influence only the mechanism governing the discharge of milk from the mammary gland. Modern work (Ely & Petersen, 1941; Miller & Petersen, 1941; Shaw, 1942; Knodt & Petersen, 1944) has amply confirmed the observation of earlier workers that after an injection of posterior-pituitary extract into an animal which has just been completely milked-out, a further quantity of milk, unusually rich in fat, can be obtained, but a survey of the earlier results provides some indication of a tendency for the extra milk so obtained to be compensated for by a reduced yield at the next milking unless posterior-pituitary extract is again injected. In accordance with this, Gavin (1913) and Shaw (1942) found no indication that the average daily milk-yield of the lactating cow is increased during a period of repeated injections. On the other hand, Knodt & Petersen (1944) reported that in cows in declining lactation the rate of decline was somewhat diminished during a period in which, after each milking, the residual milk was made available by oxytocin injections. These authors, however, correctly ascribed their results not to a galactopoietic action of the oxytocin but to the beneficial effects on the function of the secretory cells of more efficient removal of milk from the alveoli.

Quite soon after the discovery of the effect of posterior-pituitary extract on the mammary gland, some workers (e.g. Heaney, 1913; Schäfer, 1915; Gaines, 1915) came to the conclusion, which in its essentials is accepted today, that the posterior-lobe extract favours the discharge of milk from the mammary gland by causing contraction of smooth-muscle cells, or other cells with similar contractile properties, present in the mammary tissue. The milk present in the lumina of the alveoli and the finest ducts (i.e. the major proportion of the milk present in the mammary gland), which is there tenaciously held presumably by capillary forces, is believed to be thereby squeezed under pressure down into the larger ducts and, in species in which these are present, the milk-cisterns, from which it readily flows during milking.

The nature of the cells in the mammary tissues which are supposed to contract under the influence of posterior-lobe extract is, however, at present not very clear. Swanson & Turner (1941) claim to have demonstrated, more conclusively than has previously been possible, the presence in the udder of the lactating cow of cells in close association with the alveoli which have the appearance and staining-properties of smooth-muscle fibres. This claim, if confirmed, would do much to resolve any difficulties regarding a possible mechanism for the effect under discussion. If, however, these authors are referring to myo-epithelial cells (the so-called basket-cells), it should be pointed out that the contractile properties of these cells have never yet been demonstrated, having only been inferred by analogy with the properties of smooth-muscle cells (see for instance Babkin, 1944). Nevertheless, the available evidence is such that there can be little doubt that injection of posterior-pituitary extract causes some contraction of the mammary tissues, and this was demonstrated in man in a particularly simple, yet effective way by Heaney (1913), who appears

<sup>7</sup> [BMB 1104]

<sup>8</sup> [BMB 1102]

to have been the first clearly to enunciate the currently-accepted view of the action of posterior-pituitary extracts on the mammary gland.

The oxytocic principle of the posterior lobe seems to be more active in its effect on the mammary gland than the pressor principle (Ely & Petersen, 1941) though Turner & Cooper (1941), who attempted to devise a quantitative assay-method based on this response, found more activity in posterior-pituitary extracts rich in the pressor principle than they expected on the basis of the amount of oxytocin present, and in consequence they put forward the suggestion that the effect might be due to the combined action of the oxytocic and pressor principles, or even perhaps to some third factor present in both types of posterior-pituitary extract.

The question whether the posterior pituitary plays any physiological role in the normal process of suckling or in artificial milking immediately presents itself. This possibility which has recently been put forward, and in favour of which a certain amount of rather circumstantial evidence has been adduced, is discussed in an accompanying article (Folley, 1947), to which the reader is referred. It remains only to add in this connexion that the observations of Smith (1932) and Houssay (1935a) indicate that lactation is possible in the absence of the posterior hypophysis, while Gomez (1939, 1940) found that hypophysectomized rats receiving replacement-therapy lactated better if regular injections of posterior-pituitary extract were given.

### 9. Initiation of Lactation

Though, as is well known, secretion begins in the mammary gland mid-way through pregnancy, copious lactation usually does not begin until shortly after parturition, save in what must be regarded as exceptional cases, such as in goats belonging to "deep-milking" strains which often secrete appreciable quantities of milk even before mating. The mechanism governing the initiation of copious lactation in the ordinarily-understood sense has been the subject of much speculation. Practically all theories which have been put forward postulate an inhibitory influence operating during pregnancy, variously identified with the placenta, the corpus luteum of pregnancy, the distension of the uterus and so forth, the removal of which at parturition permits the full expression of the secretory activities of the mammae.

We need consider only modern theories. The first of these to take account of the lactogenic function of the anterior pituitary was put forward by Nelson, who has ably summarized (Nelson, 1936) much evidence in support of it reported in his earlier papers. Briefly, the theory holds that oestrogen, probably of placental origin, holds secretion in check during pregnancy by inhibiting the secretion of prolactin, an action probably reinforced by an inhibitory influence exerted directly on the mammary gland. The fall in the level of circulating oestrogen at parturition permits the release of prolactin by the hypophysis and hence the initiation of full lactation.

This theory has been criticized by Meites & Turner (1942a), who are not convinced that oestrogen, at any rate in physiological titres, does in fact inhibit lactation. They adduce results which indicate that oestrogen even in enormous doses always causes an increase, never a decrease, in the prolactin content of the pituitary. This provides them

with the starting-point for a new theory (Meites & Turner, 1942a, 1942b, 1942c, 1942d) according to which an increase in the hypophyseal secretion of prolactin (deduced from observed increases in pituitary prolactin-potency in small animals) is the decisive factor for the initiation of lactation. During pregnancy, the oestrogen known to be circulating in large amounts is prevented from exerting its effect on the hypophysis by the overriding antagonistic action of progesterone, an influence which is eliminated at parturition. This theory is thus a modern derivative of older theories which regarded the initiation of lactation as a progesterone-withdrawal phenomenon, but is more detailed in its exposition of the supposed mechanism involved.

The evidence in favour of this ingenious theory cannot be considered in detail here; it must suffice to say that much of it is based on increases, or lack of them, in the pituitary prolactin-content, in small animals, observed under various experimental and physiological conditions, and in particular an increased pituitary prolactin in response to oestrogen and following parturition, which stands in contrast to the absence of effect when sufficient progesterone is given together with oestrogen.

Certain objections may be raised against this theory however. Limitation of space precludes adequate discussion, but the more cogent can be briefly indicated. The theory concentrates on prolactin as the sole anterior-lobe lactogenic hormone while, as we have seen, the status of prolactin in this respect is somewhat equivocal. Indeed, Hurst & Turner (1942) have admitted that in the mouse, at any rate, other hormones must also be involved in the initiation of lactation. More serious is the fact that the adequacy of the method used by Turner and his colleagues for measuring changes in the prolactin potency of the pituitary in small animals, on the reality of which the validity of the theory depends, is open to question (Hall, 1944b). Moreover, even if the observed changes are real, they may merely reflect storage-phenomena due to inhibition of release rather than increased secretion of prolactin. Finally, it is doubtful whether the high gravimetric progesterone/oestrone ratios found necessary by Meites & Turner (1942b) for the suppression of the oestrogen effect actually obtain during pregnancy. Very much lower ratios were found to be necessary for optimal mammary growth, which is a typical pregnancy phenomenon (Scharf & Lyons, 1941).

Nevertheless, if the Meites-Turner theory must, for the reasons stated above, be treated with reserve for the present, it must be remembered that the phenomenon of oestrogen-induced lactation, discussed in a previous section of this article, inevitably leads to the conclusion that relatively-low levels of circulating oestrogen are, as suggested by Folley (1941), capable of evoking the secretion by the hypophysis of the lactogenic and galactopoietic hormone-complexes. It may be that during pregnancy the oestrogen levels are indeed high enough partially to inhibit hormone secretion by the anterior lobe, and that at parturition the oestrogen level falls through the region between the thresholds for pituitary inhibition and stimulation, thus causing release of sufficient of the relevant hormone-complexes to release the mammae into full function (see Folley & Malpress, 1947).

Finally we may mention the views of Petersen (1944), which take into account the fact that the secretory phase is established at mid-pregnancy or thereabouts. Petersen ascribes the copious postpartum flow of milk to the action



of oxytocin, circulating at that time, which causes expulsion of the contents of the alveoli and finest ducts, after which

full secretion is maintained by the stimuli of suckling or milking (see accompanying article by Folley, 1947).

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# THE NERVOUS SYSTEM AND LACTATION

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- 1 Sympathectomy and lactation
  - 2 Suckling-stimulus and milk-secretion
  - 3 Discharge or withdrawal of milk from the mammary gland : physiology of milking
- References

Contemporary interpretation of much of the earlier work on the physiology of lactation was often subject to a certain amount of confusion because of failure to recognize the distinction between the formation of milk and the discharge or withdrawal of pre-formed milk from the mammary gland. Discussion of the relation of the nervous

system to lactation will be greatly clarified if clear definitions covering this and other distinctions are laid down at the outset. The author therefore proposes that the total phenomenon which in this review is to be called *lactation* shall be considered as consisting of three sub-phenomena according to the following scheme.

- |                                                                                                |   |                                                            |   |           |
|------------------------------------------------------------------------------------------------|---|------------------------------------------------------------|---|-----------|
| (a) Synthesis of milk by the cells of the alveolar epithelium                                  | } | (A) Milk-secretion                                         | } | Lactation |
| (b) Passage of milk from the cytoplasm of the mammary epithelial cells into the alveolar lumen |   |                                                            |   |           |
|                                                                                                |   | (B) Discharge or withdrawal of milk from the mammary gland |   |           |

Where such terms as *lactation*, *milk-secretion*, and *milk-discharge* are used in this article, they are used advisedly and in accordance with this scheme.

In the era before the rise of modern endocrinology, the attention of lactational physiologists was naturally concentrated on the possible role of the nervous system in lactation. The early experiments in which attempts were made to denervate the mammary gland, tended to indicate that the growth and function of the mammary gland were independent of the nervous system and must be considered as

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being under the control of humoral influences. For reviews of these early experiments the reader is referred to Basch (1906) and Turner (1932). Perhaps the most conclusive experiments demonstrating the seeming paramount importance of hormonal factors in lactation were transplantation-experiments, a modern example of which is that of Stricker (1929).

With the rise of endocrinology as an independent and powerful science during the last two decades, and in view of the profound advances in lactational physiology which have resulted, there has perhaps been a tendency to overlook the part, important even if indirect, which neural mechanisms play in lactation. It is one of the aims of this review to show how modern work, revealing as it does an interplay between neural and hormonal mechanisms, is leading to a more balanced view which gives the important role played by the nervous system in lactation the recognition it deserves.

Though no one has yet provided any evidence whatever of the existence of secretory innervation of the mammary gland, there are several possible ways in which the nervous system may participate in the control of lactation. What seem to be the most important of the possibilities of more direct intervention are summarized below.

(a) The nervous system may affect lactation through its control of the calibre of the mammary blood-vessels on which would depend the rate of blood-flow through the mammary gland, and hence the rate of supply of milk-precursors to the secreting cells.

(b) The rate of secretion of hormones concerned in the initiation and maintenance of milk-secretion may be to some extent under nervous control. This may well apply particularly to certain anterior-pituitary hormones as will be seen later.

(c) Nervous influences may be concerned in the mechanism governing the discharge or withdrawal of milk from the mammary gland (i.e. in the natural process of suckling or artificial milking by hand or by machine). In this way also the nervous system may affect the total phenomenon of lactation, since a partial failure of the discharge-mechanism, leading to habitual incomplete withdrawal of milk from the gland, may well adversely affect milk-secretion and thus, by leading to its premature termination, amount to a failure of lactation. It is virtually certain, as will be seen later, that neural and even psychological factors are heavily involved at this point of the scheme outlined above, particularly in the domestic mammals kept by man as milk-producers, and are probably of outstanding importance in man himself.

Of these possibilities most is known about the last two, which will be considered in turn. Other possibilities such as the possible influence of nervous mechanisms on the permeability of the mammary alveolar cells to milk-precursors on the one hand, and milk-constituents on the other, lie at present entirely in the realm of speculation, since the existence of secretory nerve-fibres, comparable for instance with those regulating the activity of the cells of the salivary glands, has not been demonstrated. Before proceeding, however, to the two main themes of the present discussion, it is proposed to deal briefly with more or less recent experiments on the effect of sympathectomy on lactation, since these may be considered to be the modern analogues of the earlier experiments on the spinal denervation of the mammary gland.

## 1. Sympathectomy and Lactation

Fairly recently, a few experiments on the effect of sympathectomy on lactation have been carried out. Observations on lactation following sympathectomy operations have been reported by Cannon & Bright (1931) on one cat and one bitch, by Bacq (1932) on the rat, and by Simeone & Ross (1938) on the cat, as a result of which some commentators have shown a tendency to believe that sympathectomy causes impairment of lactation, although perhaps after some delay. There is no space here to give an analysis of these results, but it may be said that critical examination of the papers in question should convince the reader that in no case were sufficient animals involved, nor were the observations sufficiently numerous and definite, to exclude the possibility that any lactational disturbances or deficiencies observed subsequent to operative interference with the sympathetic ganglia were purely coincidental. It may therefore be concluded that at present there are no adequate grounds for any belief that sympathectomy interferes with lactation. The results of Houssay (1935a, 1935b) are in accord with this conclusion, since he reported that anterior-pituitary extract would initiate lactation in bitches from which the lumbar-sympathetic chains had been removed.

## 2. Suckling-Stimulus and Milk-Secretion

At the present time there is an ever-increasing interest in the factors which control the secretory activities of the pituitary gland, and already there is a certain amount of evidence which suggests that the secretion of some at least of the anterior-lobe hormones may be under the regulation of nervous stimuli. Of particular interest for our present purpose is the idea that the secretion of prolactin may be mediated by a nervous reflex in response to mechanical stimulation of the nipple.

It is well known that the weaning of the young is followed by rapid involution of the mammary gland, which was once believed to be due to the effects—perhaps chemical, perhaps mechanical—of the accumulation of milk. The observations of Selye (1934), however, first provided an indication that the removal of the suckling-stimulus is probably an even more important factor than non-removal of secretion in causing the onset of mammary involution. Conversely, it follows of course, that if Selye is right, the suckling-stimulus is continuously necessary for the maintenance of the functional integrity of the mammary gland. Selye (1934) found that in the rat, the prevention of the egress of milk by ligation of the main galactophores is not followed by the characteristic, rapid mammary involution if active suckling is continued. Further, involution was considerably retarded in glands which could not be suckled because of excision of the nipples, provided that other glands in the same animal, left with intact nipples, were suckled. H. Selye and his collaborators (Selye, Collip & Thomson, 1934, give a full discussion) were thus led to suggest that the suckling-stimulus initiates a nervous reflex which elicits the secretion of prolactin by the anterior lobe. In the case of the experimental animals just cited, the hormone is of course circulated to all glands alike, and thus maintains the secretory activities not only of normal glands but of glands from which the escape of milk has been surgically prevented.

The effect of the nursing-stimulus as distinct from the removal of secretion in retarding mammary involution has been confirmed in broad principle in mice by Williams (1941), who, however, observed less diminution of secretory activity in suckled glands from part of which no milk could be drawn because of appropriate duct-ligation, than in unsuckled (thelectomized) glands in the same animal. Earlier results of Hooker & Williams (1940) can also be considered as generally in accord with those of Selye, since although suckling of some mammae did not entirely prevent involution of other glands in the same mouse from which milk could not be withdrawn because of excision of the nipples, nevertheless involution of the thelectomized glands was much retarded as compared with post-weaning involution. Similarly in the rat, Grégoire (1947a) observed partial involution in suckled glands in which the galactophores were cut and in thelectomized glands in animals in which other (intact) nipples were suckled, but in neither case was the involution as rapid as after removal of the young. Weichert (1942), however, found that in rats with small litters which left some glands unsuckled, the latter underwent involution which was striking in comparison with the suckled glands; but it was still not as rapid as after weaning. In sum it may be said that while these more-recent studies indicate that the suckling-stimulus may not entirely prevent involution, even over relatively short periods, in unsuckled or unemptied glands, they confirm Selye's views to the extent that in general they show that the suckling-stimulus *per se* does retard mammary involution to a considerable degree.

Engelbrecht (1935) has made some interesting observations (widely quoted no doubt because the elegance of the technique used appeals to the imagination of many commentators) which at first sight might appear to provide additional evidence that the mammary glands are responsive to a neurohormonal reflex of just the type we are discussing. He showed that if in the lactating rat the spinal cord is cut at such a level as to denervate the six posterior mammae, and the young are prevented from suckling the six anterior nipples, then they die from lack of milk. If, however, suckling of two of the thoracic glands with intact sensation is allowed, milk is copiously secreted by all glands alike, and the young thrive. In view of considerations later to be advanced, however, these experiments cannot be considered a critical test of the particular neurohormonal theory of Selye, since it is not certain how far they were concerned with the milk-discharge mechanism (a breakdown in which would perhaps lead to total lactational failure), rather than with failure of milk-secretion as such.

Hooker & Williams (1940) attempted to simulate the suckling-stimulus by the chemical irritation provided by the periodic application of turpentine to the nipples of weaned mice, and showed that not only was involution retarded in the glands corresponding to the treated nipples, but that similar effects were manifested to varying degrees in other glands of the same animal. Mixner & Turner (1941) confirmed the effect of turpentine, regularly applied to the nipple, in retarding mammary involution after weaning in mice, but considered the effects as local, due to hyperaemia, rather than as systemic.

A certain amount of additional experimental evidence may be cited which is in harmony with the concept that the suckling-stimulus causes reflex secretion of prolactin by the anterior pituitary.

In the first place, administration of prolactin to mice from which the litters have been removed retards mammary involution and tends to maintain the epithelium in a secretory state (Hooker & Williams, 1941; Williams, 1945). Somewhat similar results in rats have been reported by Grégoire (1947b), though Weichert (1942) found that prolactin failed to maintain complete activity in unsuckled glands in the rat even though other glands in the same animal were suckled.

Moreover, Reece & Turner (1937a, 1937b) found that, in the rat, application of the suckling-stimulus after a short period of non-suckling caused a decrease in the pituitary prolactin-potency as compared with unsuckled controls. This happened also in rats in which the galactophores had been ligated to prevent the escape of milk, thus showing that the effect was due to the milking-stimulus and not to milk-withdrawal. Similar results for the guinea-pig and rabbit were reported by Holst & Turner (1939). C. W. Turner and his school interpreted these results as indicating that suckling causes a discharge of prolactin from the pituitary. On the other hand, the long-term effect of regular suckling as contrasted with non-suckling appears to be an increase in the prolactin content of the hypophysis (Meites & Turner, 1942a, 1942b), which the Missouri group consider to be indicative of increased prolactin secretion. Thus, if one accepts their interpretation, regular suckling would appear to be necessary to maintain the high prolactin-output by the anterior lobe essential for milk-secretion. It should be pointed out, however, that if these results are to be accepted as evidence for the point at issue, one must be prepared to overlook Hall's (1944) criticisms of the methods used for the assay of the prolactin content of the small-animal pituitary and also the possibility that the increase in pituitary prolactin, even if real (but see Hall, 1944), may reflect merely a storage-effect, due to a decreased rate of release, rather than an increase in the rate of production. A further indication that suckling may increase the secretion of prolactin by the pituitary is however provided by the observations of Desclin (1945), who observed degranulation of the acidophils in the rat pituitary following suckling. It has been quite generally agreed that prolactin is secreted by the pituitary acidophils (Azimov & Altman, 1938; Schooley & Riddle, 1938; Friedman & Hall, 1941; Everett & Baker, 1945), though recently it has been claimed that a special type of acidophil, the carminophil cell, is involved (Dawson, 1946).

One further observation which may be fitted into the general picture may be mentioned. Selye & McKeown (1934a, 1934b, 1934c) found that application of the suckling-stimulus to normal, cyclic female rats and mice induced a condition reminiscent of the condition of pseudopregnancy evoked by sterile copulation or cervical stimulation, in that the oestrous cycles were interrupted by prolonged dioestrous periods during which mammary growth occurred. These phenomena occurred only in the presence of the ovary. This condition of "suckling pseudopregnancy" which, it is interesting to note, Mixner & Turner (1941) failed to induce in cyclic rats by periodic application of turpentine to the nipples, is explicable in the light of the modern conception of prolactin as a third gonadotrophin (luteotrophin) responsible for the maintenance of luteal function (for references to some of the papers which cite evidence in favour of this concept see Hisaw & Astwood, 1942; Parkes, 1944; Hooker, 1946) provided that one assumes

that the suckling-stimulus causes the release of prolactin by the hypophysis.

Related observations, such as those of McKeown & Zuckerman (1938), who found that destruction of the corpora lutea of lactating rats was not followed by oestrus, provided that suckling was continued, and of Desclin & Grégoire (1937), who observed luteinization of ovaries implanted into rats spayed at parturition, again only in the presence of suckling, while they are not necessarily concerned with prolactin secretion do add to the evidence that suckling can profoundly modify the secretion of hormones by the anterior hypophysis. A similar conclusion follows from the results of Desclin (1947), who found that suckling prevented the appearance of "castration cells" in the hypophyses of rats spayed at parturition and subjected to ligation of the galactophores, and of Grégoire (1947a) who found that gestational involution of the thymus was to some extent maintained in spayed parturient rats with galactophores cut, provided that suckling was maintained. Since in neither case could the effects of suckling be simulated by prolactin administration (Desclin, 1947; Grégoire, 1947b), it would appear that nervous control of other anterior-pituitary functions—secretion of follicle-stimulating hormone and adrenotrophin respectively—was involved.

Though, as we have seen, there is considerable circumstantial evidence in favour of the existence of a neuro-hormonal mechanism responsible for the maintenance and perhaps the initiation of lactation, we are on much less sure ground when we come to the question of the neural pathways involved. The sensory nervous pathway from the mammary glands to the higher centres of the central nervous system is not difficult to visualize in broad outline, but the terminal links in the pathway from the hypothalamus to the adeno-hypophysis are far from clarified. While the existence of nerve-fibres passing from the hypothalamus to the pars nervosa is fully established, the evidence for similar fibres extending from the pituitary stalk into the pars distalis is still conflicting (e.g. see Green & Harris, 1947). In this connexion, recent experiments on the effect on lactation of section of the pituitary stalk are of obvious interest, but unfortunately the available evidence is far from unanimous. On the one hand Herold (1939) and Desclin (1940) reported that the young of lactating rats which underwent stalk-transection died despite vigorous suckling, and concluded that the production of lactogenic hormones was maintained by impulses from the diencephalon passing through the infundibular stalk. On the other, Dempsey & Uotila (1940) found stalk-transection to be without effect on lactation in the same species, a result in agreement with one case in the human reported by Dandy (1940). A later paper by Jacobsohn & Westman (1945) reports results which are at first sight somewhat intermediate between these two points of view, in that, though pituitary-stalk transection in lactating rats was followed by considerable mammary involution and the sucklings died, the involution was, however, not so complete as after weaning or hypophysectomy. They therefore seem disinclined to accept the interpretation of Herold and Desclin. Jacobsohn & Westman point out that stalk-transection inevitably involves considerable interference with the blood-supply of the pituitary, which might result in temporarily-diminished secretion of the anterior-pituitary hormones necessary for the maintenance of lactation, and hence in temporary failure of lactation until the re-establishment of

an adequate hypophyseal circulation. By this time, however, it might well be that the young are past saving, and considerable areas of the mammae irreparably involuted, so that functional response to anterior-lobe hormones is no longer possible. In areas in which involution is less advanced secretion might ultimately become re-established, as Jacobsohn & Westman suggest. Herold and Desclin performed their operations after parturition, just as did Jacobsohn & Westman in some cases, so that operational damage to the pituitary might well have been a factor. Desclin, however, reported the presence of functional anterior-lobe tissue in those of his animals in which stalk-transection—as revealed by subsequent histological examination—was complete and which failed to rear their young. Moreover, he found that in cases where the operation subsequently proved to be incomplete the young were reared, and such cases might be considered as providing the control operations which the other investigators omitted. In the experiments of Dempsey & Uotila, a considerable time was allowed for recovery from the effects of the operation before the rats were mated, so that some sort of hypophyseal circulation might well have been re-established, but the lactational data, as given, are hardly sufficient to allow of the conclusion that lactation was normal.

The results of the experiments on pituitary-stalk transection thus contribute very little to the elucidation of the question of the mechanism governing prolactin secretion. In any event it must be remembered, just as in the case of the results of Ingelbrecht (1935), that even if it were proved that stalk-transection interferes with lactation, the result would not necessarily be relevant to the truth or otherwise of the theory of Selye, since the observed lactational failure might equally well be due to destruction of the mechanism governing milk-discharge, in which nervous impulses passing through the pituitary stalk are also probably involved (see below).

Incidentally, in the present connexion it may be well to remember that there is good reason for the belief that in forms such as the rabbit, which do not ovulate spontaneously, it is probable that the activity of the anterior hypophysis is stimulated by a reflex pathway involving the hypothalamus and the infundibular stem. Another possibility that should be considered, however, is that the anterior lobe may be stimulated humorally by an agent reflexly secreted by the neurohypophysis and passing to the adeno-hypophysis by the portal vessels (see Green & Harris, 1947).

One further point regarding the possible effect of the suckling-stimulus on milk-secretion must be borne in mind. Since there is considerable evidence (see Folley<sup>1</sup>, 1947; Young<sup>2</sup>, 1947) that a complex of anterior-lobe hormones, rather than prolactin alone, is responsible for the maintenance of lactation, if a neurohormonal reflex of the kind postulated by Selye does operate to maintain lactation it must almost certainly cause the discharge by the anterior lobe of other hormones besides prolactin.

Though the removal of the suckling-stimulus is undoubtedly an important factor in bringing about mammary involution after weaning, it seems probable that the effects of non-removal of milk also make some contribution.

<sup>1</sup> [BMB 1101]

<sup>2</sup> [BMB 1104]

Selye & McKeown (1934c) found that while lactation in mice may be prolonged for more than two months by the repeated fostering of actively-suckling litters, involution (of a histologically abnormal type) does eventually occur. Moreover it should not be forgotten that Kuramitsu & Loeb (1921) and Hammond (Hammond & Marshall, 1925) had many years previously reported involution in glands, the suckling of which was prevented by occlusion of the nipples with collodion, despite the continuation of suckling at other glands in the same animal (see also Fauvet, 1941). Some other cause than the two just mentioned must be postulated to account for the gradual involution which occurs in the mammae of milk-producing ruminants despite regular application of the milking-stimulus always accompanied by withdrawal of milk.

### 3. Discharge or Withdrawal of Milk from the Mammary Gland: Physiology of Milking

The process of obtaining the full yield of pre-formed milk from the mammary gland by suckling, or in the case of domesticated milk-producing animals such as the cow and goat by artificial hand- or machine-milking, involves far more than evoking mere relaxation of the teat-sphincter and the removal of milk by rhythmic compression of the teat (and perhaps, in the case of the human, the lactiferous sinuses) and gentle suction. It is a psycho-physiological complex, the details of which are only now in the process of being elucidated. Of necessity, most of the existing information has been obtained from investigations on the cow, and to a lesser extent the goat, and the present discussion will thus be centred on the physiology of milk-discharge as it applies to milking of the cow. It seems likely, however, that similar considerations will apply to other animals; a recent clinical contribution by Waller (1943) certainly suggests that they apply to suckling in woman.

The main facts governing the milking-process in the cow are summarized in their essentials in this paragraph. They exist as scattered observations in the literature, often published in rather obscure journals, but happily many of them have been succinctly reviewed and collated by Hammond (1936) in a valuable article to which the reader is referred for references to the original papers; lactational physiologists are indebted to J. Hammond for this able appreciation of the diffuse literature of a rather obscure field. The mammary gland of the cow or goat is provided with a cistern or system of cisterns which, together with the larger ducts, are capable of storing a certain amount of milk between milkings. This, however, amounts to a relatively small proportion of the milk present in the udder at milking-time, most of which is tenaciously held, presumably by capillary forces, in the lumina of the alveoli and in ducts of very fine calibre. If a teat is cannulated in such a way as to avoid sensory stimulation of this or other teats (incidentally this would seem, from the work of Gaines, 1915, to be far from easy), only the milk present in the cisterns and larger ducts can be so removed; the full yield of milk from the cannulated gland can be obtained only when its own or another teat in the same animal is properly palpated, or any other milking-stimulus, to which the animal is conditioned, is applied. In the normal course of events, the application of the suckling- or milking-stimulus is followed, after a brief interval, by a sudden rise in

milk-pressure within the udder—the so-called “let-down”—only after which can the full yield be obtained.

Hammond (1936) has drawn attention to much evidence, existing in the literature, which effectively disposes of the fallacious idea, once widely held and surprisingly persistent, which ascribed the pressure-increase to reflex secretion of milk. This and other evidence he put forward in support of the theory that the “let-down” is due to a nervous reflex, initiated by stimulation of the teat, as a result of which the milk is squeezed down from the alveoli and finer ducts into the larger ducts and cisterns, from which it readily flows during milking. It was held that this reflex can be conditioned to sensory stimuli associated with the normal routine of preparation for milking, and can be inhibited by impulses from the brain arising from unfavourable stimuli such as sudden noises or the approach of an unfamiliar milker. The idea that the “let-down” is due to a nervous reflex was, of course, not new; for instance Gaines (1915) believed that it was caused by reflex contraction of smooth-muscle fibres in the mammary tissues in response to stimuli normally associated with suckling. Hammond, too, postulated a purely nervous arc, but conceived the terminal stage as involving a state of “erection” of the udder tissues, efferent impulses from a centre in the cord being supposed to cause contraction of smooth-muscle fibres running in conjunction with or over the venous vessels of the udder, thus occluding them and engorging the udder-tissues with blood. Hammond suggested that the mechanism of udder “erection” was somewhat similar to that involved in erection of the penis; if this were so, it would of course be necessary to assume the occurrence of *relaxation* of the tonus of the smooth muscles in the walls of the arterial vessels of the udder. Hammond also considered the possibility that the reflex contraction of myo-epithelial cells (basket cells) surrounding the alveoli might be involved in the “let-down”, but the existence of myo-epithelial cells in close connexion with the alveolar epithelium, at any rate in decisive numbers, has never yet been conclusively demonstrated (but see Swanson & Turner, 1941), neither has anyone yet seen a myo-epithelial cell, in the mammary gland or elsewhere, contract (see Richardson, 1947)<sup>3</sup>. The contractile properties of myo-epithelial cells have been assumed only by analogy with the structural appearances of smooth-muscle cells.

In recent years this theory has had to contend with a rival which postulates a neurohormonal mechanism as responsible for the “let-down”, the centripetal portion of which is purely neural while the centrifugal portion involves a hormonal phase. This theory developed from the undoubted fact (see accompanying article<sup>4</sup> by Folley, 1947) that injection of posterior-lobe extract evokes in the mammary gland a condition resembling the “let-down”, in that its administration to a lactating animal causes a sudden increase in the milk-pressure, presumably due to a “contractile process” involving smooth-muscle fibres or other cells with similar properties in the mammary tissues, thus forcing the milk from the alveolar tissues and favouring its ejection or withdrawal from the gland. The neurohormonal theory holds that stimulation of the teat or other conditioned stimulus causes reflex secretion of the oxytocic

<sup>3</sup> [BMB 1099]  
<sup>4</sup> [BMB 1101]



principle by the posterior pituitary, which in turn, by evoking the contraction of smooth-muscle tissue in the mammary gland, is directly responsible for the "let-down".

Many years ago, Gaines (1915) described interesting experiments which, as we can recognize today, strongly suggested a physiological role for the posterior pituitary in normal suckling or in the milking-process. Perhaps the most cogent of these for the point under discussion was the demonstration that, while anaesthesia inhibited the "let-down" in a bitch, so that the pups suckled in vain, they were able to satisfy their hunger shortly after the anaesthetized mother received an injection of posterior-pituitary extract. Gaines, however, did not specifically postulate a physiological role for the posterior lobe in the suckling- or milking-process, though he drew attention to the similarity between the effects on the mammary gland of the nursing-stimulus and those of posterior-pituitary extract, and it remained for Ely & Petersen (1941), on the basis of experiments in which *inter alia* they showed that, in cows in which the motor nerve-fibres to one half of the udder had been severed, the "let-down" could be evoked by oxytocin or alternatively inhibited by fright or injections of adrenalin in both halves of the udder alike, to postulate what seems, in the light of present knowledge, perhaps the most plausible theory of the mechanism of milk-discharge yet advanced—a theory which incorporated the idea that the ejection of milk from the udder depends on a balance between circulating oxytocin and adrenalin. Incidentally, in connexion with these experiments of Ely & Petersen on nerve-section, the possibility of the regeneration of inguinal nerve-fibres during the two months which elapsed between the operation and the experimental observations, was pointed out by Espe (1947), but it seems likely that this possibility is remote. Further evidence that the agent directly responsible for the "let-down" was hormonal in nature was later reported by Petersen & Ludwick (1942), who state that addition of blood from a cow in which the "let-down" had been induced in the usual way, to the fluid perfused through an isolated udder, caused the ejection of milk from the latter, while blood from an unstimulated cow was without effect. These experiments have so far been reported only in a short abstract; in view of their interest, it is a pity that a definitive publication has not appeared.

Much of the evidence which can be adduced in favour of the neurohormonal theory of milk-discharge, just outlined, is obviously circumstantial, and much further work remains to be done before the analysis of the complex of events involved in the efficient removal of milk from the mammary gland during natural suckling or artificial milking can be considered as anywhere near complete. Thus, it cannot be taken as fully established that the oxytocic principle of the posterior lobe is the effective agent in evoking the "let-down". Turner & Cooper (1941), who attempted to devise a method of assay for what, for want of a more elegant term, might be called mammary-gland "let-down" activity, found that posterior-lobe extracts rich in pitressin were more active than would be anticipated from their oxytocin content. Their results appeared to indicate either that the effect might be due to the combined action of oxytocic and pressor factors, or to a third factor present in both types of posterior-pituitary extract. The possibility that the "let-down" might be due, at any rate in part, to a vasomotor action of the type postulated by

Hammond (1936), but evoked humorally, must therefore be considered.

In addition, there are other and more serious uncertainties regarding the means by which the increase in milk-pressure is achieved. Ely & Petersen (1941), and Swanson & Turner (1941) speak respectively of the contraction of "musculature" or "muscle fibres" surrounding the alveoli, and the latter claim to have demonstrated "the presence of cells beneath the secretory epithelium of the alveoli and in the interlobular spaces which had the appearance and staining properties of smooth muscle fibres". Nevertheless, in the writer's opinion there is no satisfactory evidence yet available of the existence of smooth-muscle fibres in close association with the mammary alveoli. If these authors are referring to myo-epithelial cells (the so-called basket cells), it may once more be repeated that the existence of these rather elusive elements close to the alveolar epithelium, at any rate in numbers sufficient to account for the observed increase in milk-pressure, requires further confirmation, and in any event their contractile properties in response to oxytocin or to any other stimulus have still to be demonstrated (on these points see Richardson, 1947)<sup>3</sup>.

Notwithstanding these uncertainties, it seems fair to conclude by saying that recent work on the physiology of the milking-process has reached a stage of considerable interest from the practical aspect, if for no other reason than because of the attention it has inevitably focussed on the importance of the suckling- or milking-process as a component of the total phenomenon of lactation. As pointed out above, a failure of the milk-withdrawal mechanism will amount to a failure of lactation (see for example Gomez, 1939, 1940), and habitual failure to remove all the available milk because of some inherent defect in the discharge-mechanism, or, in the case of a cow, because of faulty milking-technique, may well react unfavourably on the secretory process in such a way as to lead to a shortening of the lactation-period. A certain amount of rather indirect experimental support for this concept has been provided by Miller & Petersen (1941) and Knodt & Petersen (1944). All will agree that more decisive experiments will be welcome.

Waller (1943) claims to have obtained evidence in support of the reasonable belief that a mechanism of the type discussed above, governing the discharge of milk, exists in women (see also Waller, 1947a, 1947b<sup>3</sup>). It is evident that psychological and neural factors must be of especial importance in man, and many cases of partial or complete lactational failure in parturient women may well be due to breakdown of the reflex mechanism called into operation by suckling.

The foregoing discussion should serve to emphasize that the physiological phenomenon which in agricultural circles has often been known as the "let-down" or "letting-down" of milk, and in medical circles as the "draught", is an *active* process. The make-shift term "let-down", used in this review for want of a better, is thus hardly appropriate, connoting as it does rather the release of some restraint on the flow of milk which otherwise would flow freely from the alveolar tissues, than an active and forceful expression of milk therefrom. Even more is it inappropriate to describe the situation in which the "let-down"

<sup>3</sup>[JMB 1110]

fails to occur, in traditional terms of the cow "holding-up" her milk. Quite apart from the fact that this may be held to imply some conscious act on the part of the animal, for which there is no evidence, it also carries the

inacceptable suggestion that the egress of milk from the alveolar tissues is actively prevented. Clearly, more precise terminology is required in this field.

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## BIOCHEMISTRY OF MILK-SECRETION

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### A Experimental methods

- 1 Arterio-venous changes in blood-composition (A-V method) in the unanaesthetized animal
- 2 Arterio-venous changes in the anaesthetized animal
- 3 The isolated perfused mammary gland
- 4 Mammary-gland slices
- 5 Use of isotopes
- 6 Effect of diet and hormones on milk-composition
- 7 Direct biochemical examinations of mammary-gland tissue

### B Findings

- 8 General
  - 9 Rate of blood-flow through mammary gland
  - 10 Respiratory quotient
  - 11 Lactose
  - 12 Milk-fat
  - 13 Casein and lactalbumin
  - 14 Citric acid
- References

The immense biological advantage that mammals have derived from the continued postpartum relationship between mother and offspring involved in the process of lactation is obviously associated with deep-seated, specialized developments of form and function in the mammalian female— anatomical and histological, physiological and biochemical. In this article it is the last of these that will receive the main attention, though clearly the biochemistry of milk-secretion cannot be dealt with entirely *in vacuo*; the gross and the minute structure of the mammary gland, nutrition and the storage of nutrients in the body, general metabolism, the endocrine control of mammary growth and function, are all closely involved.

I shall begin by stating briefly the findings which are now generally accepted as reasonably certain regarding the wider biochemical aspect of milk secretion and shall then discuss critically methods and results of fairly recent experimentation in this field.

*a.* It is quite obvious that all the constituents of the milk must be carried, in some form or another—not of course necessarily in the form in which they occur in milk—by the blood to the mammary gland, and there taken out of the blood and appropriately modified. Like blood-plasma, milk contains, in addition to characteristic constituents in easily measurable quantities, a large assortment, in smaller amounts or only in traces, of the biologically-important organic and mineral compounds present in the animal body. The peculiarly characteristic

milk-constituents, casein, lactose and milk-fat, do not occur as such elsewhere in nature, whilst citric acid, calcium, potassium, inorganic phosphate, vitamin A, vitamin B<sub>12</sub>, riboflavin, nicotinic acid and vitamin C are found in considerably greater concentration in milk than in blood-plasma. The mammary gland, therefore, is capable both of synthesis and of concentration (see table I).

TABLE I. IMPORTANT CONSTITUENTS OF BLOOD-PLASMA AND MILK

	Blood (plasma) constituents	Milk-constituents
Nitrogenous	albumin globulin *glycoprotein (a globulin) (?) amino-acids urea	[casein [lactalbumin [actoglobulin  amino-acids urea
"Fatty" ...	*blood-fat phospholipin cholesterol and cholesterol esters	[butter-fat phospholipin cholesterol and cholesterol esters
"Carbohydrate" etc.	*glucose lactic acid pyruvic acid *β-hydroxybutyric acid	[lactose traces of glucose [citric acid -
"Mineral"	*inorganic phosphate phosphoric esters potassium sodium *calcium chloride	§inorganic phosphate §phosphoric esters §potassium §sodium §calcium [chloride
Other constituents	vitamin A and carotene vitamin B <sub>12</sub> and several members of this group vitamin C	§vitamin A and carotene §vitamin B <sub>12</sub> and several members of this group §vitamin C

\* known to diminish in percentage in blood on traversing the mammary gland

† diluted in milk as compared with blood-plasma

§ concentrated in milk as compared with blood-plasma

[ characteristic milk-constituents

*b.* Milk-secretion usually takes place fairly continuously over the whole of the 24 hours of the day. Nevertheless, with an actively-lactating animal, secretion may be so rapid as to fill up and distend the storage-spaces of the gland in a very few hours to such a degree that, if suckling or milking does not take place, further milk-secretion is inhibited and, at least in the dairy cow, preferential resorption of some of the milk constituents, e.g. the fat, may take place.

*c.* There is a quantitatively large and continuous utilization of oxygen by the lactating gland. As is obvious from the very large blood-flow (mentioned again later) through this gland, and from the definitely venous character of the out-flowing blood, some carbon compound or compounds must be undergoing oxidation at a considerable speed.

*d.* Milk has, within very narrow limits, the same osmotic pressure as blood. This is to be expected, as a characteristic of an intra-cellular secretion (see later) which remains for some time in most intimate contact with the cytoplasm before it is discharged from the cell.

c. It is generally accepted that *all* the constituents of the milk are secreted by one type of cell, the large cuboid cells with big nuclei which line each alveolus of the mammary gland. These milk-secreting cells, attached to a basement-membrane, are fairly permanent structures; milk does *not* (as was once surmised) originate from the breakdown and dissolution of complete cells which are entirely renewed, time after time, from the basement-membrane. If this were so, there would be far more mitosis and cellular repair during lactation than can be observed histologically, and there would also be much larger quantities of substances in the milk derived from cell nuclei. In fact, nucleoproteins and their breakdown products are present in normal milk in no more than traces. Milk must be regarded as an extruded, intra-cellular secretion, containing at most only small quantities of cytoplasmic, and practically no nuclear, material. Milk however varies so greatly in composition from one species to another<sup>1</sup> and to a lesser extent in the same animal at different times, that there must be a marked difference in the quantitative make-up of the secreting mechanism in the alveolar cells of different species, and probably also in the detailed hormonal control of that mechanism.

For present purposes the biochemistry of milk secretion may be regarded as beginning with the preparation of the gestating animal for lactation. The maternal organism has not only to meet the demands of the growing foetus, but at the same time to accumulate reserve materials for efficient lactation. A common dairy-farm practice is the "steaming-up" of a heifer or cow during the last few weeks before calving, by feeding extra concentrates, which in addition to calories should contain "digestible protein", carotene and minerals. By this means additional nutrients are stored in the pregnant animal and it has been demonstrated (Blaxter, 1944, amongst others) that increased yields of milk may be obtained in the subsequent lactation without the loss of condition of the cow which otherwise not infrequently follows if she has been inadequately fed during late gestation. The hypertrophied uterus also serves during involution as a source of nitrogen which is partially, at least, made available for synthesis of milk proteins. It has been clearly shown that the cow stores calcium and phosphorus in the skeleton during pregnancy, for release during lactation (Forbes *et al.* 1935). Warnock & Duckworth (1944) have demonstrated that in rats calcium and phosphorus are stored during gestation in the "ends" of the long bones, and that demineralization occurs in the "ends", but not to a measurable extent in the shafts, during lactation.

In the colostrum is "stored", in addition to globulin with its associated antibodies, vitamin A, and in some animals relatively large quantities of vitamin C.

The possible biochemical transformations which take place during milk-secretion will now be considered more closely. In table I is a list of some of the quantitatively more important constituents of blood-plasma and of milk. Only *plasma* constituents are given, since while it cannot be completely ruled out that the erythrocyte, in squeezing through a narrow capillary, might exchange

more than oxygen and CO<sub>2</sub> with the surrounding tissue, there is so far no definite evidence that this cell plays a direct part in the carriage of nutrients to the mammary gland.

## A. EXPERIMENTAL METHODS

### 1. Arterio-Venous Changes in Blood-Composition (A-V Method) in the Unanaesthetized Animal

The obvious way to determine what blood-constituents are taken up by any tissue for purposes of synthesis of new materials, maintenance of tissue-structure, or for the production of energy is directly to compare the composition of the blood entering, with that of the blood leaving, the tissue. This method, which is one of some experimental difficulty, has been used in the case of the mammary gland for fifteen years or more, usually with the cow or the goat, but has so far yielded somewhat disappointing results.

Arterial blood is taken from any convenient vessel in the arterial system—an accessible artery in the cow is the internal iliac artery, approached through the rectal wall (Graham, Kay & McIntosh, 1936)—and, as nearly as possible simultaneously, venous blood is taken from the easily-accessible abdominal (subcutaneous) mammary vein. Between this vein and the smaller veins draining the udder there are anastomoses, so that a sample from this vein may be taken as a fair sample of the true venous outflow. The venous sample is in practice taken a few seconds *before*, and never after, the arterial sample. It was clearly shown some years ago by the same workers that the cow is extremely sensitive to disturbance, and may react to it by rapid changes in the composition of the blood which are often sufficient to destroy the significance of any conclusions, based on arterio-venous differences, regarding the precursors in blood of the milk-constituents.

### 2. Arterio-Venous Changes in the Anaesthetized Animal

To avoid the uncertain results obtained by some of the earlier investigators who did not fully realize that excitement in the animal when blood-samples are being taken tends to invalidate A-V analyses, several experiments have of recent years been carried out on the anaesthetized animal (cow or goat), using nembutal (Reineke, Williamson & Turner, 1941; Reineke, Stonecipher & Turner, 1941; Shaw, 1946). These workers have shown that milk of normal composition continues to be secreted at normal rates by animals anaesthetized in this way.

An uncertainty, the importance of which it is not yet possible to assess, but which applies equally to the normal and the anaesthetized animal, is associated with the fact that in addition to milk and to venous blood, there is also a drainage of *lymph* from the secreting mammary gland. As to the composition of mammary lymph, little is known, though Shaw & Petersen (1940) say that it contains some calcium, but little fat. As to volume, there can be no doubt, in view of the capacious and elaborate system of lymph-vessels present in mammary tissue (El Hagri, 1945), and from general observations, that the flow of lymph in the lactating gland cannot be negligible. Whilst its volume may be small relative to that of the venous outflow, it may

<sup>1</sup> The milk of the porpoise, or whale (the offspring of which have to put on a fatty blanket as soon as possible) contains over 40 % of fat (Davies, 1939) whilst that of the mare contains about 1 %. The milk of the rabbit, whose offspring grows with great rapidity, doubling its birth-weight in 6 days, contains 10 % to 15 % of protein, and some 2.5 % of minerals, whilst that of the woman, whose offspring grows at a more leisurely rate, contains about 1/4 that amount of protein, and 1/10 that amount of minerals.

well be greater than that of the milk secreted in a given time. This awkward problem has not yet been adequately faced by those using the A-V method of studying the biochemistry of milk-secretion. Whilst it may well be that mammary lymph-flow is of little quantitative importance in drawing up the balance sheet between glandular intake and output, we shall be handicapped in arriving at any clear conclusions regarding the precursors in the blood of the milk-constituents until the composition and rate of flow of mammary lymph are considerably better known.

### 3. The Isolated Perfused Mammary Gland

To surmount some of the experimental difficulties of the A-V method in the intact animal, Petersen, Shaw & Visscher (1941) developed a technique whereby the udder of a normal, lactating cow was rapidly excised and immediately, i.e. within 7-8 minutes, perfused with warm oxygenated (defibrinated or heparinized) blood. Milk-production continues and the uptake of "precursors" from the circulating blood remains similar to that found in a normal, intact gland. By thus eliminating the cow, the distorting effect of excitement is also eliminated. Various substances suspected of being concerned in milk-production can be added to the blood, the rate of blood-flow can be accurately measured, and samples of "arterial" and "venous" blood can be taken at any intervals with great ease. The technique is clearly one that requires no little experimental skill.

In the sense that it does not circulate through the body and tap the various storage-depots, nor receive endocrine secretions, the blood used for perfusion soon ceases to be strictly arterial. The question also as to how far interference with lymphatic drainage affects the findings remains an open one. The isolated gland deteriorates fairly quickly—within some six hours. Moreover, whilst most recent observers have found respiratory quotients of above 1 (usually 1.1 to 1.3) for the normal functional mammary gland in the intact animal, the isolated perfused gland gives a value (Shaw, 1939) of 0.8.

### 4. Mammary-Gland Slices

The method of incubation, in well-oxygenated salt-solutions, of fresh slices of mammary tissue with various possible precursors of milk-constituents was first used by Grant (1935). It has recently been further developed by Knodt & Petersen (1945, 1946a), and has obvious possibilities for the future.

Mammary slices suspended in saline are, of course, very different from the intact lactating gland, but investigation of the biochemical processes which occur in such slices may at least give an indication of the synthetic and metabolic potentialities of the same tissue under more strictly physiological conditions.

### 5. Use of Isotopes

This very promising method has so far been very little used in relation to mammary secretion, either with radioactive isotopes, or with "heavy" elements such as deuterium. Earlier work of Aten & Hevesy (1938) was interrupted by the war, and later experiments of Erf

(1941), Erf & Pecher (1941), Pecher & Pecher (1941) and McConnell (1942) have not yet proceeded very far. The use of isotopes such as  $^{13}\text{C}$  has recently provided information, which may have considerable bearing on the biochemistry of mammary secretion, on possible paths in the intermediary metabolism of carbohydrates and fats in liver- and kidney-tissue.

### 6. Effect of Diet and Hormones on Milk-Composition

The study of the effect in the lactating animal of inanition (Smith & Dastur, 1938) or of feeding special diets (Hilditch & Paul, 1936; Hilditch & Longenecker, 1938; Hilditch & Jaspersen, 1941, 1943) or of treatment with hormones<sup>2</sup> such as thyroxin (Folley & White, 1936; Smith & Dastur, 1940), oxytocin (Shaw, 1942), anterior-pituitary hormones (Folley & Young, 1938; 1939), oestrogenic hormones (Folley, Watson & Bottomley, 1941), insulin (Gowan & Tobey, 1931) on the detailed composition of the milk has also thrown some indirect light on the biochemical transformations during lactation.

### 7. Direct Biochemical Examinations of Mammary-Gland Tissue

By the determination, under different physiological conditions, of tissue constituents such as glycogen (Petersen & Shaw, 1938; Knodt & Petersen, 1946b) and by direct or indirect examination of the enzymic function of the gland (Folley & Kay, 1935, 1936; Folley & Greenbaum, in press), data have been obtained which, by cautious fitting in to the puzzle, add a little more to our slowly-developing picture of mammary secretion.

## B. FINDINGS

In this section an attempt will be made to summarize and interpret the data obtained by the different methods of investigation just described. As in other sections, it will not be possible to cite here more than a few of the contributors to these data.

### 8. General

The following constituents of the blood-plasma fall in concentration in passing through the mammary gland:—blood-sugar, inorganic phosphate, "neutral fat", (Graham, Jones & Kay, 1936; Voris, Ellis & Maynard, 1940; Shaw & Petersen, 1940), calcium (Shaw, Powell & Knodt, 1942),  $\beta$ -hydroxybutyric acid (Shaw & Knodt, 1941), amino-acids (Blackwood, 1932; Graham, Peterson, Houchin & Turner, 1938; and more recent workers), one of the plasma globulins and glycoprotein (Reineke *et al.* 1941), oxygen (as oxyhaemoglobin).

The following remain without detectable change:—phospholipins, cholesterol (Graham *et al.* 1936), haemoglobin, cell-volume, pyruvic acid (Shaw, 1946). There is still some doubt as to whether there is any significant change in the concentration of lactic acid, some workers finding a diminution (Graham, 1937; Boyd & Petersen, 1938), others no change (Powell & Shaw, 1942).

As might be expected with any active tissue, there is much more  $\text{CO}_2$  in the mammary venous than in the arterial

<sup>2</sup> [See also *BMB* 1104.—Ed.]



blood. There also appears to be more urea (Graham, Houchin & Turner, 1937) in the venous blood.

### 9. Rate of Blood-Flow through Mammary Gland

The very rapid rate of blood-flow, inferred by Graham *et al.* (1936) for the cow, on the basis of the ratio of A-V changes in probable precursors to the concentration of the milk-constituents produced in the secreted milk, to be of the order of 400-500 volumes of blood per volume of milk secreted (i.e. for a good cow some 6 to 7 litres per minute), has been confirmed, by a better method based on calcium- and phosphorus-uptake from blood, by Shaw *et al.* (1942).

### 10. Respiratory Quotient

As regards the gaseous exchange, there is general agreement that, in a given interval of time, a greater volume of CO<sub>2</sub> is produced by the secreting gland than the volume of oxygen used by it (Graham, Houchin, Peterson & Turner, 1938; Reineke *et al.* 1941; Petersen & Shaw, 1942; Bottomley, unpublished experiments; Shaw, 1946; and several other workers). That a respiratory quotient exceeding 1, usually between 1.1 and 1.3, is to be found for both cows' and goats' mammary glands when the animals are normally fed, and not agitated, must be accepted as true. The classical conclusion from this would be that fat is being formed from carbohydrate but, as will be seen, this conclusion is open to doubt.

The gland of the fasting, lactating cow appears to give a respiratory quotient of below 1 (0.88, according to Shaw, 1946).

### 11. Lactose

There is little if any glucose in normal milk. The amount of glucose that disappears from arterial blood in traversing the mammary gland, which may be as great as 25 % or even 30 % of the total arterial blood-sugar, is about sufficient to account for the whole of the lactose. Grant (1935) showed that mammary-gland slices would synthesize lactose if incubated with a solution of glucose, but were not apparently able to do so from fructose, mannose, galactose, or various carbohydrate phosphoric esters. Knodt & Petersen (1943) have confirmed this synthesis, and shown that glucose + lactic acid, maltose and glycogen also give lactose under similar conditions. Gowan & Tobey some years ago (1931) in experiments on the effects of inanition, of insulin and of phlorrhizin administration on the lactating cow, were the first to show that the quantity and percentage of lactose secreted in a given time are very sensitive to a lowering of the blood-sugar level, however this lowering is brought about. Their findings on the intact animal were confirmed by others, and similar results were obtained in the excised, perfused udder by Knodt & Petersen (1946b), who found that the addition of insulin to the perfusing blood causes a rapid drop in lactose-production in the gland. Glycogen, however, increased in quantity in the insulinized gland. These effects were found either with a normal blood-glucose, or when additional glucose was put into the perfusing blood.

The normal lactating gland contains some 0.2 % of glycogen (Petersen & Shaw, 1938), but the non-lactating gland very little. It may well be that glycogen is an intermediate stage between blood-glucose and milk-lactose.

The circumstantial evidence—and not all is quoted here—that lactose is derived from blood-glucose is thus very strong, but whether a part of the blood-glucose taken up is used for energy-purposes in the gland, or even for manufacturing some milk-constituents other than lactose, is by no means clear.

So many oxidizable carbon compounds in addition to glucose are taken up from the blood by mammary tissue (e.g.  $\beta$ -hydroxybutyric acid, glycoprotein, blood-fat and even amino-acids) that it is not yet possible to state with certainty which, if any, are actually consumed for energy-purposes in the gland. Shaw considers that  $\beta$ -hydroxybutyric acid is one of the principal substances so used. It seems to me conceivable, in fact likely, that, as in other tissues, several of the blood-constituents may be in equilibrium with glycogen or some other labile substance within the large alveolar cells, in such a way as to provide enough precursor both for lactose-secretion and for energy-purposes. Recent experimentation with <sup>13</sup>C and other isotopes has demonstrated that some of our earlier views as to the limits of interconvertibility, in the presence of the powerful enzymic systems in the more active tissues, of biologically important carbon compounds may have been too conservative.

### 12. Milk-Fat

There is sufficient neutral fat taken up from the arterial blood to account quantitatively for all the milk-fat secreted by the lactating gland, but when cows' milk-fat is examined in detail, it is found that some 30 % of the fatty acids belong to the short-chain C<sub>4</sub>-C<sub>14</sub> series, which do not appear to be present in the blood-fat. Milk-fat, therefore, could not be produced merely by concentrating the neutral fat of the blood; more-extensive biochemical changes are involved. Moreover, the question again arises as to what part, if any, of the absorbed blood-fat is used in the gland for energy-purposes? Is part of the milk-fat—say the lower fatty-acid part—synthesized from other sources than blood-fat, perhaps from carbohydrates or from  $\beta$ -hydroxybutyric acid (a possibility suggested by Shaw & Knodt, 1941)? This is at least not rendered less likely by the fact that the respiratory quotient of normal mammary tissue is greater than unity.

As a result of detailed analysis of milk-fat, Hilditch & Sleightholme (1931) suggested that the glycerides containing short-chain acids might be produced in the mammary gland by oxidation of the alkyl end of longer-chain fatty acids of oleo-glycerides without actual hydrolysis of the latter. Hilditch & Paul (1936) brought further evidence in favour of this inherently rather surprising suggestion (which was made before Kelly & Petersen (1939) showed that free fatty acid was present to a much greater extent in lactating than in dry mammary glands), and Smith & Dastur (1938) interpreted the results of their experiments on the effect of inanition on the distribution of fatty acids in milk-fat, in which they found that the content of short-chain fatty acids decreased markedly whilst there was a corresponding increase in oleic acid, as supporting Hilditch's views. The findings of previous observers that

the respiratory quotient of the mammary gland of the *fasting* cow is less than 1, were confirmed by Shaw, Powell & Knodt (1942), who examined the milk-fat secreted by cows with severe ketosis (ketonaemia with hypoglycaemia) accompanied by varying degrees of inanition. They showed that the proportion of short-chain fatty acids was, in this condition, much below normal, in spite of the large excess of  $\beta$ -hydroxybutyric acid in the circulating blood. They consider therefore that this substance is excluded as a possible source of the short-chain fatty acids. On feeding large quantities of glucose to cows with ketosis, the proportion of very-short-chain fatty acids increases.

One cannot avoid associating these findings, as well as those of Smith and Dastur just quoted, with the recent results from Barcroft's laboratory where it has been found (Barcroft, McAnally & Phillipson, 1944; McAnally & Phillipson, 1944; Elsdon, Hitchcock, Marshall & Phillipson, 1945; Danielli, Hitchcock, Marshall & Phillipson, 1945) that the ruminant is able to take up short-chain fatty acids, resulting from the microbiological breakdown of carbohydrate in the rumen, direct through the rumen wall, and that these acids may circulate in the blood. On the other hand, unpublished preliminary experiments carried out by Malpress in 1940, in which relatively large quantities of sodium butyrate were fed to lactating ruminants, gave no detectable increase in the proportion of volatile fatty acids in the milk-fat.

In the case of human milk-fat, Hilditch & Meara (1944) have shown that there is no butyric and practically no  $C_6$  or  $C_8$  fatty acid present. There are about the same quantities of  $C_{10}$ ,  $C_{12}$  and  $C_{14}$  acids as in cows' milk-fat. (They point out, incidentally, that in regard to its component acids, human milk-fat has far more resemblance to a typical fat-blend of margarine than to butter-fat!) Shaw and his colleagues have expressed the opinion that the percentage of lower fatty acids in cows' milk-fat is much more closely associated with food-intake than with the level of blood-glucose, of lactic acid or of acetone bodies, and the findings of Hilditch and Meara may perhaps be interpreted as giving support to the view that these lower fatty acids are in some way related to the *ruminant* digestion of carbohydrate.

It must be remembered that the modern high-yielding cow—and this applies also to the goat—is an animal with an abnormally hypertrophied mammary system, and that the demands of the udder both for energy and for the precursors of the milk-constituents may be so insistent that extraordinary biochemical changes, such as the oxidation of part of the long-chain fatty acids of blood-fat to produce energy, may take place. In the goat, these acids are of rather longer chain-length—more  $C_6$ ,  $C_8$ ,  $C_{10}$  and less  $C_4$ —than in the cow. But how to reconcile these suggestions with the experimental finding that the respiratory quotient of the normal (cow's) mammary gland is greater than unity, i.e. that there is synthesis in the gland of oxygen-poor from oxygen-rich carbon compounds, remains an unsolved problem.

The fat of cows' milk, as secreted, contains in solution in the fat-globules, but not in the aqueous phase of the milk, both vitamin A and its precursor, carotene. Two remarkable observations which may eventually throw light on milk-fat secretion, and for which any complete biochemical account of mammary secretion will have to find a place, have recently been made by Kon and his

colleagues. The first (Kon, Mawson & Thompson, 1944) is that whilst the vitamin-A content of milk-fat is more or less independent of the *size* of the fat-globule, i.e. the large, medium and small fat-globules all contain approximately the same proportion of vitamin A, the same is not true for carotene, of which the proportion is greater the smaller the fat-globule, i.e. there is more carotene as the relative surface-area/volume of the fat-globule becomes greater. The second (Kon & Ganguly, unpublished experiments) is that whilst in milk vitamin A is present almost entirely in the ester form, it is present in blood almost entirely as the unesterified alcohol.

### 13. Casein and Lactalbumin

Of cows' milk-proteins, casein is present in by far the largest quantity, some 2.9 % of the weight of the milk, lactalbumin is present to the extent of about 0.4 %, and lactoglobulin to about 0.05 % to 0.1 %. The last was shown by Crowther & Raistrick in 1916 to be identical with one of the globulins of bovine blood, whereas lactalbumin is not present in the blood-stream. Less is known with certainty about the precursors of the first two milk-proteins than about those of lactose or of milk-fat, perhaps because the lymph-leakage, mentioned earlier, has even more serious consequences in disturbing the protein balance-sheet than it has for that of carbohydrate or fat.

It has been accepted for some time that the total amount of amino-acids taken up as such by the lactating gland is insufficient to account for more than a small fraction of the protein appearing in the milk. Suggestions had been made from time to time that one or other of the major proteins of the plasma, after suffering a structural change of some magnitude, but probably not undergoing complete hydrolysis and resynthesis in the mammary gland, is the chief source of the major milk-proteins, but the first real evidence of such an origin was provided in 1941 by Reineke, Williamson & Turner, who found that an appreciable quantity of one of the blood-globulins, a glycoprotein, the molecule of which is believed to contain some 9 % of a carbohydrate-complex of galactose, mannose and glucosamine, leaves the arterial blood in its passage through the gland. The carbohydrate moiety of this protein may be concerned either in lactose-production or as a source of energy, but the other 90 % of the molecule is regarded by these workers as the main source of the milk-proteins. In view of the peculiar amino-acid constitution of casein, it is clear that in this case there must be some molecular rearrangement of the globulin, accompanied by subtraction of certain amino-acids, probably followed by their oxidation. This may account for the finding that more urea is present in the mammary venous than in the arterial blood. The problem of casein-formation is rendered even more complex by the observation that casein is a mixture of proteins with slightly different properties and composition (Linderström-Lang, 1929) and different molecular weights.

Casein is, of course, a phosphoprotein, whilst the glyco-protein, from which it may well be formed, is not. By the use of radio-active phosphorus, Aten & Hevesy (1938) have shown that the phosphorus organically combined in the casein molecule is provided from the inorganic phosphate of the circulating blood.

## 14. Citric Acid

Citric acid, present in blood only in traces, occurs to the extent of some 0.2 % in cows' milk. Of the solid constituents of milk which remain after the major ones—lactose, milk-fat and protein—have been subtracted, it therefore forms about one-third. It is of great biochemical interest, as either citrate (or isocitrate with which it is in equilibrium) is now believed to be concerned, in many tissues at least, in the intermediary metabolism of carbohydrate, of fatty acids and of amino-acids alike. Its presence in milk may indicate its central importance in the biochemical changes accompanying milk-secretion.

The percentage of citric acid in blood is so small and analytical methods for determining it in these quantities are so relatively imprecise, that it cannot be said whether or not it is taken up from the blood by the mammary gland. Recent work of Knodt & Petersen (1946a) indicates, however, that mammary-gland slices incubated at 37.5°C. for 6 hours in the presence of oxygen with various substances—glucose, pyruvic acid, glycogen, maltose, lactic acid—or to a lesser extent when incubated alone without any addition, produce readily-recognizable amounts of citric acid, the amounts being greatest with glucose, and least with lactic acid. In presence of added  $\beta$ -hydroxybutyric acid, very little additional citric acid is formed. When large quantities of citric acid are added to mammary slices, some of it disappears.

Isolated mammary-gland tissue, therefore, can synthesize citric acid from various sources. It would be of interest to know whether added fatty acids or amino-acids increase the amount of citric acid produced by mammary slices under these conditions.

\* \* \*

If there is one lesson which seems to me to emerge from the results at present available on the biochemistry of milk-formation, particularly when regarded in the light of the fairly recent disclosure of a far greater extent of interconvertibility than was previously supposed between proteins, fats and carbohydrates and the products of their hydrolysis and oxidation in many active tissues, it is that there is almost certainly a much more labile equilibrium within the alveolar secreting cells between the various substances taken in from the blood-stream and the various constituents of the milk in process of formation in those cells. It may eventually prove to be somewhat of an absurdity to speak of the blood precursors of this or that milk-constituent, or the source of energy for mammary metabolism, since different precursors for the same milk-constituent or different materials for combustion within the gland for energy-purposes may be used at different times—or even several at the same time—by the lactating mammary gland, depending, if commercial jargon may be allowed, on the current supply-position.

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## EXPERIMENTAL STIMULATION (GALACTOPOIESIS) OF LACTATION

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- 1 Action of anterior-pituitary extracts in declining lactation
  - 2 Action of anterior-pituitary extract in virgin animals brought into milk by oestrogen treatment
  - 3 Economics of anterior-pituitary galactopoiesis in cows in declining lactation
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Folley & Young (1940) proposed the term "galactopoietic" to describe the action of a hormone preparation which enhanced the yield of milk in an animal already lactating; a galactopoietic endocrine extract was not necessarily "lactogenic", that is to say, it was not necessarily capable of initiating the secretion of milk in a non-lactating animal. Bergman & Turner (1940) independently suggested that the term "galactopoietic" or "galactagogue" be used for substances which augment established lactation. In the present review the terms "galactopoiesis" and "galactopoietic" connote ability to enhance established lactation without reference to ability to initiate milk-production.

This review is confined to the galactopoietic action of hormonal preparations in farm-animals, and will be largely concerned with the development of researches carried out in Britain during the war with a view to determining whether or not the large-scale employment of hormone preparations could lead to a significant increase in the country's total milk-supply.

### 1. Action of Anterior-pituitary Extracts in Declining Lactation

The demonstration by Stricker & Grueter (1928) and by Corner (1930) that anterior-pituitary extracts could initiate the flow of milk in suitable animals in the laboratory paved the way for the investigation of methods of augmenting the milk-yield of farm-animals on a large scale, but it was not until the results of the experiments of Asimov and his collaborators in the USSR had been published (Asimov, Kruze, Skaržinskaja, Mahova & Fominskaja, 1936; Asimov & Krouze, 1937) that the particular galactopoietic efficacy of a *crude* anterior-pituitary extract in cows in declining lactation was demonstrated. The experiments of the Russian workers involved a single subcutaneous injection of a crude

alkaline extract of ox anterior-pituitary tissue into a group of more than 500 cows in declining lactation. Such simple treatment induced substantial temporary increase in the milk-yield, the composition of the milk remaining normal. According to the investigators, the extra milk resulting from their experiments was produced at a financial profit. In the meantime, experiments involving the daily injection of large doses of prolactin (the so-called lactogenic hormone of the anterior pituitary gland) into goats (Asdell, Brooks, Salisbury & Seidenstein, 1936) or cows (Folley & Young, 1937, 1938) in declining lactation had demonstrated that a substantial increase in milk-yield could thus be obtained, but the expense of preparing prolactin from the crude pituitary extract, together with the relatively low galactopoietic efficacy of crude prolactin, precluded the use of such treatment as a practical, profit-bearing process.

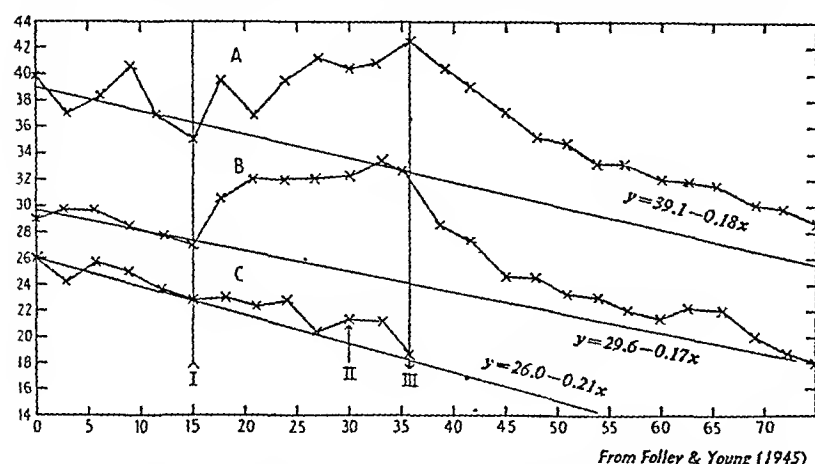
In an extensive investigation of the influence of treatment with various fractions of ox anterior-pituitary tissue on cows in declining lactation, Folley & Young (1938) agreed with Asimov *et al.* in finding that a single subcutaneous injection of a crude ox anterior-pituitary extract induced a substantial rise of milk-yield over a period of 5-6 days immediately after the injection, the mean increase in yield over this period being about 10%. Even with the high cost of ox anterior-pituitary gland obtained for experimental purposes, the whole transaction was financially profitable to the extent that the sale of the extra milk yielded a sum about 33% in excess of the cost of the glands.

Although any substantial increase in milk-yield must, in good husbandry, be accompanied by an increase in the food-supply to the animal, the basal cost of maintaining a cow, whether in milk or not, is so relatively large that the cost of the extra food required to cover an increase in milk-yield induced experimentally is always small in relation to the value of the extra milk. Accordingly, any procedure inducing an increased yield of milk in a milking animal is likely to be profitable provided that the cost of the treatment is not excessive, and it was clear from the early experiments of Asimov and his colleagues, and of Folley & Young, that pituitary treatment might provide an important and effective method of increasing milk-production on a large scale. This was of especial importance when, as was the case during and even before the war, it was desirable to increase the consumption of fresh milk by the population as a whole. Nevertheless, before the war no official interest was shown in Britain in the practical possibilities implicit in the hormonal treatment of cows in declining lactation, and the relevant researches followed conventional academic lines.

In a development of their earlier experiments, Folley & Young (1939, 1940) found that repeated injections of crude ox anterior-pituitary extract, given on alternate days over a period of about three weeks, raised the daily milk-yield of cows in declining lactation to an average level 15-20% above that expected, from control data, in the absence of treatment. Moreover there was some indication in these experiments that, as the result of treatment lasting only three weeks, the whole level of milk-yield had been raised permanently, so that the curve of decline was parallel to, but above that, to be expected had the treatment not been given (fig. 1).

In all these experiments the quality of the milk, as revealed by analysis, was unimpaired, despite the substantial increases in yield; in fact, the only significant change in milk-

FIG. 1. INFLUENCE OF INJECTIONS OF ANTERIOR-PITUITARY EXTRACT ON MILK-YIELDS OF COWS IN DECLINING LACTATION



The influence of doses of 2.5 g.-equiv. of different types of anterior-pituitary extract, injected at 2-day intervals for 3 weeks, on the milk-yields of groups of cows in declining lactation. The data given are the mean yields for each group over 3-day periods. Group A, two cows receiving a crude extract of fresh anterior-lobe tissue. Group B, four cows receiving a crude extract of acetone-desiccated anterior-lobe tissue. Group C, three cows receiving a crude extract of anterior-lobe tissue which had been desiccated in commercial methylated spirit. On day 29 the dose was doubled (group C only). The first injections were given, in each case, on day 15, and the last on day 35. The straight lines are those fitted by the method of least squares to the pre-injection control data for each group.

Abscissae : days

Ordinates : mean milk-yield, pounds/cow/day

I : injections began

II : dose doubled

III : injections stopped

composition encountered was a rise in fat-content in some, though not all, experiments. In this respect prolactin seemed to be more effective than the crude extract (Folley & Young, 1939, 1940; cf. also Sykes, Meulman & Huffman, 1942; Sykes, Gould, Duncan & Huffman, 1944).

With the deterioration of the position of Britain in 1940, it appeared desirable to reopen the question of the hormonal stimulation of milk-production in farm-animals with a view to exploring the possibility of increasing significantly the nation's milk-supply by such means. The results of such experiments with anterior-pituitary extract were not published until 1945 (Folley & Young, 1945; Fawns, Folley & Young, 1945; Folley, Malpress & Young, 1945a). On the results of previous experiments, it was decided to choose a period of three weeks as a convenient period of treatment. Pituitary injections over such a period should induce a substantial increase in milk-yield, and the increase might be expected to be of some persistence. A dose-response curve was then constructed relating the magnitude of a single dose of extract administered to the mean increase in milk-yield over the following two days. From this curve a dose of 10 ml. of extract (corresponding to 2.5 g. of fresh ox anterior-pituitary tissue and containing a total of 150-200 mg. of protein) was found to give a nearly maximal response, and this dose was chosen as suitable for the repeated administration on alternate days over a period of about three weeks. Experiment confirmed the expectation thus derived that the most economic use of the extract was likely to result from the administration of 10 ml. on alternate days over a period of 22 days (Folley & Young, 1945), and

accordingly this procedure was followed in all the later experiments.

The results of the further relevant investigations may be summarized as follows :

a. the galactopoietic activity of the crude ox anterior-pituitary extract was not lost if the extract was allowed to remain at room-temperature for 24 hours

b. repeated injections of an extract prepared from whole ox-pituitary gland (including the posterior lobe) had no deleterious effect on pregnant cows and resulted in the usual increase in milk-yield (cf. also Folley & Young, 1938)

c. galactopoietic activity was unimpaired if the anterior-lobe tissue was desiccated in acetone before preparation of the extract

d. desiccation of the gland in ethanol provided material which was almost completely lacking in galactopoietic activity

e. when groups of cows were treated, at 2-day intervals for a period of 2½ weeks, with crude sheep or pig anterior-pituitary extract, a substantial and sustained depression of milk production occurred

f. cows at the peak of lactation did not respond to treatment with crude ox anterior-lobe extract which was effective in animals in declining lactation.

The depression of milk-yield in cows resulting from treatment with pig- and sheep-pituitary extracts was provisionally ascribed to rapid antihormone formation to the heterologous

glandular material but, since the prestige of the investigators with the farmers concerned had fallen *pari passu* with the milk-yield, it was impossible to obtain the necessary blood-samples from the cows in order to support this provisional assumption. Nevertheless, since antihormone formation had previously been described to ox- or sheep-prolactin in the rabbit (Kabac, 1938; Young, 1938; Bischoff & Lyons, 1939) and to crude ox anterior-pituitary extract in the dog (Dohan & Lukens, 1939; Ennor & Singer, 1942), the assumption appeared to be a reasonable one.

It was disappointing to find that the galactopoietic effect of our ox-pituitary extract could not be demonstrated in animals at the peak of lactation since, if the peak could be raised and such a rise was followed by a decline at a normal rate (or even if the beginning of the decline could merely be delayed), a lasting effect on the milk-production during the whole of the period of decline might be expected. Such an effect would result in a substantial increase in total milk-yield. The results of Asdell *et al.* (1936) are in general agreement with ours, in that these authors found that treatment of lactating goats with prolactin had no obvious effect on milk-secretion if the treatment was begun just after the peak of lactation but, in experiments in which similar treatment was begun later in the lactation period, the milk-yield was significantly raised. As the result of experiments with 510 cows in various stages of lactation, ranging from 1-21 months after calving, Asimov & Krouze (1937) conclude that "the injection of the lactogenic substances is more effective during the first half of lactation (2-6 months)". This, by virtue of omission, may imply that



treatment was less effective during the first month after calving but, in the absence of data regarding the time of occurrence of the peak of lactation in these animals, it is difficult to determine whether or not Asimov & Krouze found any galactopoietic effect when their crude pituitary extract was administered at the peak of lactation. Our own negative results may be explained on the assumption that, during the normal period of steady milk-production after calving (which lasted about 7 weeks in the animals we had under investigations), the factor limiting the output of milk is not the rate of liberation of endogenous anterior-pituitary secretion, though this endocrine factor may become a limiting one in animals which have reached the normal period of decline.

## 2. Action of Anterior-pituitary Extract in Virgin Animals Brought into Milk by Oestrogen Treatment

De Fremery (1936) reported that virgin goats could be brought into milk by oestrogen treatment followed by injections of prolactin. Later Folley, Scott Watson & Bottomley (1940), Lewis & Turner (1940) and Walker & Stanley (1940) all independently reported that treatment with the synthetic oestrogen diethylstilboestrol alone could bring virgin goats or heifers into milk. Folley & Young (1941a) and Lewis & Turner (1942) reported that combined treatment with the synthetic oestrogen together with anterior-pituitary extract produced more milk than with oestrogen alone. Folley, Malpress & Young (1945b) found that combined treatment with oestrogen and crude anterior-pituitary extract sometimes brought into milk animals which had failed to lactate as the result of treatment with oestrogen alone. Furthermore, the anterior-pituitary extract exerted a significant galactopoietic effect at the peak of oestrogen-induced lactation, and thus was capable of significantly increasing the total amount of milk provided by these virgin animals. However, the practical value of this combined treatment on a large scale was clearly doubtful.

## 3. Economics of Anterior-pituitary Galactopoiesis in Cows in Declining Lactation

The general conclusion to be drawn from our experiments was (Folley & Young, 1945) that when cows in declining lactation were given treatment by minimally-effective dosage (*v. supra*) of crude ox anterior-pituitary extract (10 ml. subcutaneously on alternate days over a period of 22 days), animals initially producing an average of 18 pounds<sup>1</sup> of milk/day yielded, during the three-week period of injections, 21 % more than would be expected in the absence of treatment; during the two-week period following the cessation of injection on alternate days they gave 15 % above that expected. In round figures, for the total period of five weeks, each cow gave, on the average, 60 gallons<sup>2</sup> of milk instead of an expected 50 gallons. The cost of the experimentally-produced pituitary extract used during the three-week injection-period was 11 shillings per cow. The extra milk obtained, if due allowance be made for the extra food consumed by the treated cows, could be regarded as bringing a profit to the farmer of 1½ shillings

per gallon, the total gross profit thus being 15 shillings. The net profit was therefore 4 shillings. The cost of the pituitary glands, and so of the treatment, would undoubtedly be substantially reduced if the process were carried out on a large scale and, even under the expensive conditions of our experiments, would be highly profitable to the individual farmer.

For the process to be applied on a nation-wide scale, consideration must be given to the total supplies of anterior-pituitary tissue continuously available in the country, and to the fractional increase in the nation's milk supply which could be induced, under favourable circumstances, by the treatment. It seems improbable that more than 20,000 g. of ox anterior-pituitary tissue could be collected each week in Britain, which would allow of the treatment of about 2,200 cows for a three-week period. Thus about 38,000 cows could be treated each year, with an extra milk yield of about 380,000 gallons. This is certainly less than 0.05 % of the total fresh-milk supply of the country, and even if treatment with all the available pituitary extract were given during the winter months only, it is clear that no substantial increase in the nation's milk supply would accrue from the employment of pituitary stimulation as a routine process. The situation could obviously not be seriously altered even if large supplies of anterior-lobe tissue were imported from abroad. It should be pointed out, however, that this conclusion did not and does not detract from the fact that, to the individual farmer, the successful use of the process might be of considerable financial advantage.

Since the employment of anterior-pituitary extracts offered no possibility of providing a significant increase in the supply of milk for the country as a whole, two other main lines of research seemed to offer possibly valuable results: (a) the development of artificial substitutes for the galactopoietic anterior-pituitary extracts; (b) investigation of the large-scale effectiveness of other endocrine extracts, such as thyroid preparations, which were already known to possess galactopoietic activity. These two lines of research overlapped to some extent. The first required further investigation of the nature of the galactopoietic factor or factors in the crude ox anterior-pituitary extract. The earlier researches on this aspect of the subject will first be reviewed.

## 4. Nature of the Galactopoietic Factors of the Anterior-pituitary Gland

It was early shown by Riddle and his colleagues (Riddle, Bates & Dykshorn, 1933) that anterior-pituitary extracts which were capable of initiating lactation in experimental animals also possessed ability to cause enlargement of the pigeon crop-gland, and it became widely accepted that lactogenesis and ability to induce crop-gland hypertrophy were different activities of one and the same anterior pituitary hormone—prolactin. Nevertheless it was demonstrated that prolactin does not initiate milk-secretion in hypophysectomized guinea-pigs (Nelson & Gaunt, 1936; Gomez & Turner, 1936) although lactation can be induced if anterior-pituitary adrenocorticotropin is administered simultaneously with prolactin (Gomez & Turner, 1937; Nelson & Gaunt, 1937). As Folley & Young (1941b) pointed out, since either prolactin or adrenocorticotropin may initiate lactation in hypophysectomized guinea-pigs

<sup>1</sup> 11 pound = 0.454 kg.—Ed.]  
<sup>2</sup> 1 gallon = 4.55 l.—Ed.]

already under the influence of the other hormone, both have an equal claim to the description "lactogenic" under such conditions.

The early experiments of Folley & Young (1938, 1939) revealed little correlation between the galactopoietic activity of anterior-pituitary extracts and their prolactin content. In some instances, extracts which contained no detectable prolactin exhibited a good galactopoietic action in cows in declining lactation (Folley & Young, 1938), while in other experiments crude extracts of acetone-dried sheep anterior-lobe tissue, or of ox ethanol-desiccated pituitary tissue, possessed no galactopoietic activity detectable in our experiments, though such extracts were rich in prolactin (Folley & Young, 1945; Folley *et al.* 1945a). Under similar conditions a partially-purified prolactin preparation (5 international units/mg.), injected into cows in declining lactation in a dose which, measured by its stimulating effect on the crop-gland of the pigeon, was seven times as active as crude ox anterior-pituitary extract, possessed only one-third of the galactopoietic activity of the crude extract (Folley & Young, 1940). In general, the galactopoietic activity of our extracts was parallel to their influence on carbohydrate metabolism rather than to their prolactin content. Nevertheless, the possible importance of prolactin in such experiments cannot be eliminated, since the treated cows had intact pituitary glands which might have secreted extra prolactin during the experimental treatment of the animal with anterior-pituitary extracts. In an attempt to stimulate the galactopoietic action of crude anterior-pituitary extract by the simultaneous injection of a mixture of separated anterior-pituitary hormones, in 1940 Folley & Young (unpublished observations), in preliminary experiments involving a single injection of various preparations, found that little or no galactopoietic activity was exhibited in cows given a mixture of small doses of adrenocorticotropin and prolactin. Further investigations by Dr. A. Roy (Roy, to be published) have shown that the injection on alternate days of large doses of adrenocorticotropin containing no detectable prolactin can induce an increment of nearly 20% in the milk-yield of cows in declining lactation. The administration of commercial prolactin ("physolactin"—Glaxo Laboratories Ltd.) containing 10 international units/mg. induced an increase of only 12%, while simultaneous administration of the prolactin and adrenocorticotropin produced a 25% increase. There was, therefore, no evidence of a synergistic action between prolactin and adrenocorticotropin, such as would have been necessary to account for the galactopoietic action of a crude anterior-pituitary extract in terms of its relatively exiguous prolactin and adrenocorticotropin activities.

In view of the importance of adrenocorticotropin in galactopoiesis, attempts were made to find synthetic substances which might possess activity in inducing carbohydrate-storage in fasting animals, similar to that shown by adrenal-cortical steroids possessing an oxygen atom at position 11 of the steroid nucleus. Such activity is exhibited by diethylstilboestrol (Janes & Nelson, 1940) and other oestrogens (Griffiths, Marks & Young, 1941), and many such oestrogens also possess the capacity to increase the insulin content of the rat pancreas (Griffiths & Young, 1940; Marks & Young, 1940). Initially, encouraging results were obtained by Marks & Young in 1941 (unpublished observations) with non-oestrogenic derivatives of 4 : 4-dihydroxy-diphenyl ether, and Dr. James Walker kindly synthesized a number of

derivatives which might be expected to exhibit such activity (see Walker, 1942). However, the biological assays, involving a determination of liver- and muscle-glycogen contents in treated fasting mice, did not show any consistent activity which might have been of practical significance, and this line of approach was therefore abandoned. It should be mentioned that the extraction of prolactin from sources much more plentifully accessible than anterior-pituitary tissue has been described (Rabald & Voss, 1939), and had it proved possible to prepare non-oestrogenic synthetic substances with carbohydrate-metabolism-stimulating activity, it might have been feasible to combine these with extra-pituitary prolactin preparations to provide large supplies of non-pituitary material possessing, it was to be hoped, some galactopoietic activity.

### 5. Activity of Thyroid-active Substances: Iodoproteins

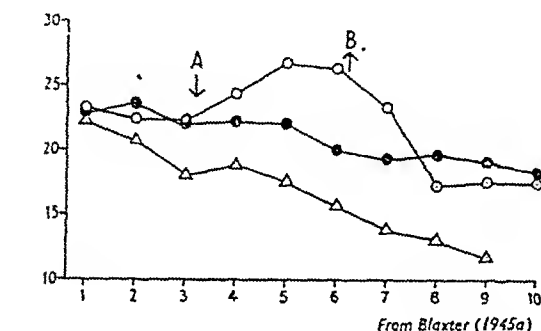
Since, for many years, thyroid preparations had been known to exert a galactopoietic action in cows in declining lactation (Graham, 1934; Jack & Bechdel, 1935; Jones, 1935; Folley & White, 1936; Herman, Graham & Turner, 1938; Smith & Dastur, 1940; Ralston, Cowser, Ragsdale, Herman & Turner, 1940; Hurst, Reece & Bartlett, 1940), our failure to evolve a large-scale method of increasing milk-supplies by the use of pituitary hormones diverted attention to thyroid preparations. In 1939 Ludwig & von Mutzenbecher showed that casein which had been iodinated under certain conditions exhibited thyroid-hormone activity, and that thyroxine could be isolated from the products of hydrolysis of such an iodoprotein. Early in 1940, the present writer suggested (see Barcroft, 1945) that investigations should be made concerning the possible large-scale usefulness of such iodoproteins in the production of milk and, as a result of the subsequent interest of the Agricultural Research Council, large-scale investigations along these lines were planned, but carried out by others. The results of the British investigations were not published until some years later (Blaxter, 1943; 1945a; 1945b), and in the meantime the results of researches in the USA along similar lines had appeared (Turner, 1940; Reineke & Turner, 1942; Reineke, 1942, 1943; Reece, 1944; Van Landingham, Henderson & Weakley, 1944; Archibald, 1945).

In 1942, Reineke, Williamson & Turner (see Reineke *et al.* 1942) introduced an important improvement in the method of preparation of thyroid-active iodoproteins by demonstrating that the activity of the iodinated material was greatly enhanced by incubation at relatively high temperature (60-70°C.). This procedure was later adopted by the British workers (Pitt Rivers & Randall, 1945).

As the result of extensive investigations, Blaxter (1945a, 1945b) concluded that when active iodoproteins were fed to cows in declining lactation, the increase in milk-yield was least at the beginning and at the end of a lactation-period. In mid-lactation, the percentage response increased as lactation declined; nevertheless the response in pounds of milk/day fell with a diminution in the initial yield. In early experiments with iodinated "ardein" (ardein is the mixed protein from the ground-nut *Arachis hypogaea* prepared by I.C.I. (Explosives) Ltd., Ardeer, Scotland), material containing 0.88% acid-insoluble (thyroxine?) iodine fed in daily doses of 50 g. for three weeks induced an increase in milk-yield 24% above that expected in the absence of

treatment, and an increase of about 10 % in the percentage fat-content of the milk. Within two weeks of cessation of the treatment, the milk-yield had fallen to a level close to that expected had treatment not been given (fig. 2).

FIG. 2. EFFECT ON MILK-YIELD OF FEEDING IODINATED ARDEIN N4MB TO COWS FOR A PERIOD OF 3 WEEKS



Abscissae : weeks

Ordinates : mean daily milk-yield in pounds

● controls  
○ 50 g. dose  
△ 10 g. dose

A : treatment commenced

B : treatment stopped

With a seven-week period of treatment the response declined after about three weeks of administration of the iodinated protein (Blaxter, 1945a). Later experiments (Blaxter, 1945b) with iodinated casein containing 1.2-2.7 % acid-insoluble iodine, fed in a daily dose of 30 g. over a period of three weeks, again showed a mean rise over the experimental period of about 25%. With 30 g./day of iodinated casein, the symptoms of hypermetabolism were very pronounced; with a daily dose of 20 g., the galactopoietic response was only about two-thirds of that with the larger dose, but since only slight symptoms of hypermetabolism were then found, this seemed to be the dose for choice. There was no immediate evidence that the symptoms of hypermetabolism encountered had any lasting deleterious effect on the treated animals.

The American workers have on the whole used smaller amounts of iodoprotein than British investigators. Thus, Reineke & Turner (1942) gave 50-100 g./day of iodinated milk-protein to cows in declining lactation for only three days, while Reece (1944) fed 10 g./day for three weeks, and Archibald (1945) gave 15 g./day for six weeks. The mean increases in milk-yield were of the order of 10 %. In general, the results of the British and American workers are in agreement.

Although increases in the fat-content of milk have frequently been found to follow the administration of thyroid-active substances to cows, the results with iodoproteins both in Britain and in the USA have not been consistent from time to time, though in a proportion of instances significant rises in fat-content have accompanied the increases in milk-yield (Blaxter, 1943; 1945b; Reece,

1944). Archibald (1945) found a significant fall in the casein-content of milk to follow administration of iodoproteins to cows; on the whole, it may be concluded that the extra milk obtained as the result of treatment with iodoprotein is generally of at least unimpaired quality.

The results at present available concerning the use of iodoproteins as a practical galactopoietic measure suggest that if, as the result of long-term observation of treated cows, no serious disability is encountered, such as diminished fertility or reduced resistance to infection, the measure may become of the greatest importance in dairy husbandry. It must be emphasized that, so far, long-term observations which will conclusively allow the ultimate innocuousness of the treatment to be accepted are not available. With regard to the short-time results, the advantages of the treatment are manifest. Iodoproteins of substantial thyroid activity can be prepared very cheaply on a commercial scale in almost unlimited supply; the cost of the treatment is very small indeed and it can be applied to large numbers of animals without difficulty. Furthermore, unlike pituitary extracts, which must be administered parenterally, iodoproteins can be given by mouth in the normal food. This fact is of significant practical importance particularly in large-scale work. Developments in the large-scale use of iodoproteins in dairy-farming will be awaited with interest.

It was of some theoretical, and perhaps of practical interest, to know whether the galactopoietic effect of thyroid-active substances and that of crude anterior-pituitary extract would be additive or would be synergistic. With this end in view, Dr. A. Roy has recently determined the effect of giving thyroxine by injection simultaneously with crude ox anterior-pituitary extract to cows in declining lactation. During a three-week period of treatment, the extra milk provided by treatment with the anterior-pituitary extract alone was 19 %; with thyroxine alone (10 mg. on alternate days), the increase was 16 %; while with the two treatments given simultaneously the rise was 36 % (Roy, to be published). There was therefore no evidence of a significant synergistic action of the two treatments.

## 6. Relationship of Galactopoiesis and Other Endocrine Phenomena

Growth, including foetal growth, and milk-production, are processes requiring a special type of metabolic control, in that they both necessitate the preservation from oxidation of foodstuff that would otherwise, in an animal in equilibrium, be oxidized. All our highly active pituitary galactopoietic preparations have also been capable of inducing growth when administered to intact rats and, it may be pointed out, thyroid preparations can induce growth not only in thyroidectomized animals but also, under some conditions, in intact animals. Folley & Young (1938) early pointed out that galactopoietic pituitary preparations possessed anti-insulin activity, and Young (1940, 1945) has emphasized the growth-stimulating activity of his diabetogenic pituitary extracts.

Since growth, galactopoiesis and diabetogenesis all involve a restraint on oxidative processes, it would not be surprising if there were some relationship between the hormonal mechanisms concerned with the control of these phenomena.

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## EXPERIMENTAL INDUCTION OF LACTATION

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- 1 Oestrogenic stimulation of lactation
  - 2 Practical applications
  - 3 Explanations of the dual action of oestrogens
  - 4 Role of progesterone
- References

That oestrogens should recently have been used, and with considerable success, for the experimental induction of lactation in non-gravid non-parturient animals is at first sight surprising, for the evidence available hitherto had mostly indicated that the action of these hormones was to inhibit, and not to promote, milk-secretion. This evidence accrued from many sources: lactation, for example, had been frequently observed in guinea-pigs following the cessation of oestrogen injections initially given to produce mammary growth (Nelson, 1937; Laqueur, Borchardt, Dingemans & de Jongh, 1928); while many authors, following Parkes & Bellerby (1927), demonstrated that oestrogen injections could inhibit established lactation in small mammals (de Jongh, 1933a, 1933b; Smith & Smith, 1933; Robson, 1935; Noble, 1939).

Advantage has also been taken of this function by clinicians, who have found oestrogens a valuable aid in suppressing lactation in women when breast-feeding for one reason or another has become undesirable (e.g. Ramos & Colombo, 1938; Barnes, 1942; Walsh & Stromme, 1944), and we may also note that it was in such belief that Nelson was led to propound his oestrogen-inhibition theories explaining the absence of lactation during pregnancy and its sudden onset at parturition (Nelson, 1936).

### 1. Oestrogenic Stimulation of Lactation.

While the import of these experiments could not be doubted, there were certain anomalous results which suggested that a more complex interpretation of oestrogenic action might prove needful. The work of Frazier & Mu (1935), in which lactation was produced in male rabbits injected with oestrogen, is an example, as also the observation (Anselmino & Hoffmann, 1936) that rat-litters suckled by oestrogen-injected ovariectomized does suffered no diminution of their growth-rates when compared with control-litters.

The bulk of the evidence demonstrating the power of oestrogens actively to initiate milk-secretion derives however, and for practical reasons which must be clear enough, from investigations in which either goats or cows have been used

as experimental subjects; it may be noted that the inhibitory action of oestrogens upon lactation is well attested for both these species.

De Fremery (1938) and Trautmann & Kirchhof (1939), working with goats, had already observed lactation following the combined use of oestrogen as a mammary-growth stimulant and prolactin as a specific for milk-secretion when, in 1940, Folley and his co-workers reported the first conclusive demonstration of lactation following treatment with oestrogen alone (Folley, Scott Watson & Bottomley, 1940). These authors, who gave their results more fully in a second paper (Folley, Scott Watson & Bottomley, 1941a), rubbed the udders of virgin goats with an ointment containing 1% of diethylstilboestrol or its dipropionate, and in one case obtained a maximum daily yield of 2 litres of milk in response. These results were independently confirmed by Lewis & Turner (1940), using an oestrogen-injection technique.

Studies on cattle were first reported by Walker & Stanley (1941), who obtained lactation-yields comparable with those of normal parturient animals from two heifers given injections of diethylstilboestrol dipropionate, either alone or in conjunction with testosterone propionate. Folley *et al.* (1941b) also reported small yields from oestrogen-injected heifers and, as the result of these pioneer efforts, a great deal of work has since been undertaken with the aim of augmenting available milk-supplies by bringing otherwise valueless, barren animals into production by means of an oestrogen-induced artificial lactation.

### 2. Practical Applications

The greater part of this subsequent work, together with a few other closely-related papers, has been very conveniently published in a single number of the *Journal of Endocrinology*. Papers by Folley & Malpress (1944a, 1944b), Folley, Stewart & Young (1944), Hammond & Day (1944) and Parkes & Glover (1944) reporting the use of oestrogens administered by various techniques—synthetic oestrogens orally or by subcutaneous implantation, or single injections of different esters—show that these authors all reached very similar conclusions with regard to the merits or limitations of the general treatment and the inadvisability of its immediate widespread application on farms.

Briefly, the treatment was condemned as a practical measure in its present forms, primarily because of the lack of uniformity in the results. Whatever effective oestrogen-dosage was given—and it is known that in this respect the experiments as a whole covered a very wide range—the results in individual cases were quite unpredictable, and yields were too often well below an economically-satisfactory limit, or even nil. On the other hand, many animals gave daily full yields of milk, equal to the best that might have been expected of them as the result of normal calving. Thus, 3 gallons [13.6 l.] a day were often exceeded and, what is more, obtained within two months of the start of treatment when, had a successful mating taken place instead at the same time, seven more months of the gestation-period would still have had to run before any milk at all could be obtained. The method might have an important application therefore in helping a farmer to get winter-milk from a dry animal which he has failed to settle in calf by the autumn—an important consideration in the general problems of milk-production.



A further observation which contra-indicated the use of oestrogens in this way was the occurrence of pelvic changes in the treated animals, more pronounced but similar in character to those accompanying normal parturition; these, when aggravated by the behaviouristic attitudes (repeated coital mimicry) associated with the animals' nymphomaniac condition, led in a number of cases to pelvic fractures unless the animals had been isolated from the herd during the course of treatment.

Yields normally rose to a peak value within one to three months when the implantation method was used, and thereafter declined slowly provided that the oestrogenic stimulus was removed. If the treatment was continued at this point, however, yields fell rapidly, and an oestrogen-inhibitory phase was evidently produced. The original papers should be consulted for a full appraisal of the different experimental techniques from the practical point of view; it is important to note, however, that in all cases where the daily milk-yield was greater than 5 pounds [2.3 kg.], the chemical composition of the milk was normal with respect to all its major constituents (Folley & Malpress, 1944c).

Other reports dealing with this problem of artificial lactation are confirmatory in their import, or provide later supplements to the publications already quoted (Reece, 1943; Day & Hammond, 1945; Spriggs, 1945).

### 3. Explanations of the Dual Action of Oestrogens

The theoretical implications of the treatment are of great interest: in the first place it has become clear that the effective systemic oestrogen-concentration is of paramount importance in conditioning the response, or lack of response, and a tentative theory put forward by Folley (1941) sought to reconcile the apparently contradictory effects of oestrogens upon lactation by postulating a differential action of the hormone upon the lactogenic-hormone secretion of the pituitary. It was suggested that small concentrations of oestrogen might promote, and large concentrations inhibit, pituitary activity in this respect. Support has since been given to such a theory by the work of Mixner, Meites & Turner (1944), which showed that while the daily injection of 0.25 mg. diethylstilboestrol promoted lactation in non-parous goats, amounts of 1 mg. or more were inhibitory to animals already lactating. A slight amplification of this original theory, in which not one, but two threshold-values of systemic oestrogen-concentration are envisaged as defining pituitary lactogenic activity, might perhaps explain most satisfactorily at the present time the observed practical results. These two thresholds, a lower, below which no stimulus is given to lactogenic-hormone secretion and an upper, above which its secretion is inhibited, will determine the limits of an intermediate zone of stimulatory oestrogen-concentrations within which the pituitary may be regarded as actively releasing hormones of the lactogenic complex. Since Folley & Malpress (1944a) found that from implantations, daily absorptions ranging from 4-24 mg. could be associated with copious lactation, while absorptions falling well within this range often had negligible effect, it becomes necessary to postulate either that the stimulatory and inhibitory threshold-concentrations of oestrogen in the blood can vary widely both absolutely and relatively, between individual animals of the same species; or that

the endogenous-oestrogen secretion of the animal is, in its turn, subject to great individual variations, or perhaps that rates of synthetic-oestrogen excretion and catabolism may differ and systemic oestrogen concentrations be affected accordingly.

Until further work has been done on the metabolism of the synthetic oestrogens, little can be said on the significance of the last possibility, but of the two other explanations the first is undoubtedly the more attractive, for there seems but little likelihood—having regard to the inactive ovarian states induced by oestrogen treatments—that any appreciable endogenous oestrogen will be present to supplement the hormone exogenously applied. The double-threshold theory, moreover, does suffice to explain many of the observed results quite convincingly: it will be clear, for instance, that, where the threshold-values are very different, there will be a large range of oestrogen-concentrations able to promote lactation, whereas when they are close together the stimulatory range will be small and the difficulty of bringing such an animal into artificial lactation will be enormously increased; that such difficulties should exist tallies with field-experience. Further, the sudden increase in yield, noticed when oestrogen treatment is stopped after a peak yield has been obtained and an inhibitory phase of lactation-decline produced, may well be caused by a transitory passage of the now-falling systemic oestrogen-concentration through the stimulatory range, before reaching the still-lower zone where no effect at all is exerted on the pituitary.

### 4. Role of Progesterone

Apart from the effect on lactation, however, the importance of the type of glandular tissue which develops after simple oestrogen treatment cannot be overlooked. In the treated animals, lactation must clearly be both preceded and accompanied by mammary growth, and although there are some indications that species may differ one from the other regarding the exact stimuli required for normal development, recent experiments on the rabbit (Lyons & McGinty, 1941; Scharf & Lyons, 1941) have suggested that a definite ratio of progesterone to oestrogen is essential for such development, and that an imperfect balance between these two hormones may lead to a stunted or otherwise abnormal parenchyma.

We might argue from this that in the goat or cow a more abundant lactation might be induced by combining our simple oestrogen treatment with progesterone administration, and experiments have been devised by Mixner & Turner (1943) to test this hypothesis. They found, by the examination of histological and of dissected sections, that the lobule-alveolar response in the goat to treatment with diethylstilboestrol alone was in fact rarely typical of the development in the normal gland, and that in those cases in which progesterone was also given, the approach to a normal histological structure was much closer. Their results imply, therefore, that although oestrogens given alone may be suitable for the induction of lactation in non-breeding dairy animals, the chances of success should be enhanced by the simultaneous administration of progesterone. The validity of interpretations based on comparative studies of histological sections of lactating mammary tissue must, however, depend on the trustworthiness of the techniques employed. In particular, it is to be doubted whether small specimen blocks

cut from the udder can be considered in any way representative of the whole gland; sectioning the whole udder, on the other hand, involves special problems of fixation demanding suitably adapted procedures. Recognizing this, Cowie, Folley, Malpress and Richardson, in recent and unpublished work, have started to re-investigate this question of the role played by progesterone in the development of the mammary gland of the goat, milking the animals as completely as possible before mastectomy, and afterwards fixing the whole gland by immediate arterial perfusion. By this means it becomes possible to examine histologically transverse sections of the whole udder, and although a sufficient number of animals has not yet been treated, the authors are at present inclined to the view that there is no significant quantitative superiority of the alveolar tissue of animals treated with both progesterone and oestrogen, over that taken from animals injected with oestrogen alone. It remains, of course, a distinct possibility that the ratio of the two hormones used in these experiments may not be optimal for mammary growth in this species or, again, that the quantitatively uncertain, and unassessed, effect introduced by the secretion of substances having progestational activity by the adrenal gland, may be influencing the results—as indeed it may be doing to a variable, but significant degree, in all experiments of this kind.

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As an addendum it is interesting to note here the limited success encountered by various authors in their attempts to develop and initiate lactation in the male gland by oestrogen treatment (Hogrove, 1936; de Fremery, 1938; Folley, Scott Watson & Bottomley, 1941a). Folley & Malpress (unpublished work), in an attempt to improve upon these failures, implanted tablets of both progesterone and oestrogen

in a steer. There was only a slight development of the gland, and milk-secretion was limited to a few millilitres daily for a period of a few weeks.

\* \* \*

The question of the galactopoietic activity of pituitary extracts is considered elsewhere<sup>1</sup> in this publication but it is of importance here to recall the interesting experiments of Folley & Young (1941), Lewis & Turner (1942), and Folley, Malpress & Young (1945), in which goats or cattle receiving apparently-inhibitory doses of oestrogen were induced to lactate by the additional use of pituitary preparations containing prolactin and probably other components also of the lactogenic-hormone complex. These experiments emphasize the connexion between inhibitory oestrogen-titres and the suppression of the pituitary principles which initiate and maintain lactation, and indicate that we might certainly hope for a far greater success in our field-trials were pituitary extracts available in greater quantity.

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Undoubtedly, then, our further advance in solving the problems of the artificial induction of lactation depends on a better understanding of the quantitative interdependence of oestrogen and progesterone in mammary growth, and of oestrogen and the pituitary lactogenic hormones in the control of lactation. This knowledge will need to be general, and yet also to allow particular reference to the individual animal, and it would seem unwise, until such additional information becomes available, to prophesy any outstanding advances in our efforts to make the artificial induction of lactation in barren animals a factor of real importance in commercial milk-production.

<sup>1</sup> [BMB 1104]

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## CLINICAL TREATMENT OF HYPOGALACTIA BY HORMONAL METHODS

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- A Varieties of hypogalactia
- B Controls treated by non-hormonal methods
- \*C Hormonal methods
  - 1 Dried thyroid gland
  - 2 Anterior-pituitary extracts
  - 3 Oestrogens
- D Conclusions
- References

Since the discovery of ductless glands and of hormones, various attempts have been made to use them to influence the course of lactation in women. Owing to the confused state of our present knowledge concerning the effect of hormones on lactation in women, Prof. F. G. Young suggested that the matter should be investigated. With the support of the Medical Research Council, and on the clinical advice of Mr. J. M. Wyatt, F.R.C.S., F.R.C.O.G., and later of Mr. A. J. Wrigley, F.R.C.S., F.R.C.O.G., such an investigation was begun at St. Thomas's Hospital in 1944, and extended in 1946 to University College Hospital by the kind permission of Prof. F. J. Browne, and subsequently of Prof. W. C. Nixon. The following is a review of the results obtained.

### A. VARIETIES OF HYPOGALACTIA

There are two classes of dairy-cows—the “sprinters” and the “stayers”. In the early weeks of lactation, the sprinters are the prize milkers, but their milk-yield ceases very early. The stayers are the good dairy-cows, who give a steady moderate yield of milk over a longer period. The same is true in women. Women can be divided into five classes of milkers:

1. *Stayers*. As in cows, there are women who give, over a period of about 9 months, a daily output of milk which is just adequate for the needs of the infant. This is normal lactation, and needs no treatment.

2. *Sprinters*. As in cows, these women yield very large quantities of milk during the first 2-4 weeks of lactation, and then quite suddenly the supply ceases at about the 6th week of lactation.

3. *Stickers*. These women produce sufficient milk to satisfy their infants during the first 2-3 weeks of life. If the infants are test-fed daily during the first 2 weeks, and then once a month up to the 6th, it is found that the milk output in these women rises to a certain level, and then remains more or less at that level throughout the six months of lactation. The infants need to be partly bottle-fed

from about 4 weeks of age. Test-feeding during the puerperium shows that the milk in these women does not reach 10 ounces<sup>1</sup> on the 5th day, nor 16 ounces on the 10th day; whereas, in the sprinters and stayers, the total milk-yield on the 5th day is over 10, and on the 10th day is over 16 ounces.

4. *Non-starters*. These patients produce little or no milk on the 5th day of the puerperium. If the breasts are soft and flabby, a little colostrum can be expressed. If the breasts are lumpy and painful, only a few drops of fatty secretion can be expressed.

5. *Abscess-producers*. These patients usually belong to the sprinter-class. In the puerperium, mastitis often causes their lactation to fail. In the later months of lactation (especially during the first three months), breast-abscesses cause their lactation to fail.

Hypogalactia occurs in the puerperium among the patients who are either stickers or non-starters. It is diagnosed by a total output of less than 10 ounces on the 5th day, or less than 16 ounces on the 10th day of the puerperium.

### B. CONTROLS TREATED BY NON-HORMONAL METHODS

82 puerperal women were used as controls. They were divided into five groups. One group had no treatment. The others were treated at random with either massage, a proprietary galactagogue, inactive pills or daily intramuscular injections of physiological saline. The massage and inactive pills were given only from the 5th or 6th day of the puerperium until discharge from hospital. The saline injections were given once daily on 5 consecutive days. The proprietary galactagogue was given until lactation had failed, or until the sixth month of lactation was reached.

The mean output for the 82 controls was 5.9 ounces per day before treatment started. It rose to 8.0 ounces per day during treatment. When the infants were one month old, it had risen to 8.4 ounces per day, and then began to fall. When the infants were six months old the mean output per day had fallen to 3.5 ounces.

### C. HORMONAL METHODS

#### 1. Dried Thyroid Gland

The earliest known attempt to use hormones to stimulate lactation was made by Hertoghe (1896), who reported an increase in the milk-yield, both in women and in cows, when they were given dried thyroid-gland substance by mouth. His work, however, was not followed up by others, and was forgotten. Recently, interest in dried thyroid gland has been revived by reports of its use as a galactagogue in cows. During the last few years, several clinicians have unsuccessfully treated deficient lactation in women with tablets of dried thyroid gland by mouth. Their results do not seem to have been published. On enquiry, it was found that the dose of dried thyroid gland used was  $\frac{1}{2}$ -grain<sup>2</sup> tablets twice or three times daily by mouth, and that the infants were more than 2 weeks old when the treatment was begun. At St. Thomas's Hospital it had been found impossible to stimulate failing lactation with dried thyroid gland after the end of the puerperium, whether the patients belong to the classes of milkers called sprinters,

<sup>1</sup> [1 ounce = 28 g.—Ed.]

<sup>2</sup> [1 grain = 66 mg.—Ed.]

stickers, or non-starters, or have failed because of a breast-abscess.

A series of 14 women, suffering from hypogalactia in the puerperium, was given by mouth  $\frac{1}{2}$ -grain tablets of dried thyroid gland (thyroideum siccum, B.P. 1932) four times daily, starting on the 6th or 7th day. The mean increase in milk-yield was the same whether the treatment ceased on discharge from hospital, or whether it was continued until lactation had failed, or until the infant was six months old. The mean increase in the milk-yield during treatment was only slightly better than it was among the controls. Instead of decreasing after the 4th week of lactation, as it did among the controls, the mean daily milk-yield continued to rise up to the 6th week of lactation, and then remained steady up to the sixth month.

Following this experiment, 100 puerperal women suffering from hypogalactia were divided into six groups. Each group was given at random varying doses of dried thyroid gland by mouth. The dosage was from 4.9 grains of dried thyroid gland per day. The treatment lasted from 4-8 days, ending when the patient was discharged from hospital, or when the milk-yield had risen to 16 ounces per day. The increase in the mean output per day during treatment was highest (150%) among the patients receiving 8 grains of thyroid per day. The highest percentage (50%) of patients reaching an output of 16 ounces per day occurred among those who were given daily either 6 or 7 grains of dried thyroid gland. Further test-feeding of the infants of those women who had attained an output of 16 ounces before discharge from hospital has shown that the rise in output continues at least up to the third month. This experiment is too recent for any more to be said of it at present.

Twenty-five puerperal women suffering from hypogalactia were given by mouth 1.6 mg. of thyroxine per day for from 3-5 days. The mean increase in milk-output was equivalent to that of the women who had received 8 grains of thyroid per day. Fifty per cent. of these women were producing 16 ounces of milk per day before discharge from hospital, and their output continued to rise after discharge.

Why some patients respond so well to dried thyroid gland and thyroxine, while others show little or no response, is at present unknown. In some patients the pulse-rate rose to 100 per minute, but no signs of thyrotoxicoses were encountered.

## 2. Anterior-pituitary Extracts

Stricker & Grueter (1929a; 1929b) discovered that once the mammary glands had developed, injections of an extract of anterior-pituitary gland caused the secretion of milk to begin. A hormone, prolactin, has been isolated, and Kurzrok, Bates, Riddle & Miller (1934), Ross (1938), Kenny & King (1939), and Stewart & Pratt (1939) have all reported a certain amount of success in stimulating lactation by injecting it. The success reported by these observers has not, however, been confirmed by others, and prolactin has fallen into disuse.

At St. Thomas's Hospital, 67 puerperal women suffering from hypogalactia were treated with crude anterior-pituitary extract. The extract was injected intramuscularly once daily on 5 consecutive days. Injections of physiological saline were used as a control. The extract was prepared as described by Young (1941), and was supplied

by Glaxo Laboratories Ltd. The results were similar to those in the control cases.

Similar results were obtained with women in the later weeks of lactation.

## 3. Oestrogens

### a. Ante-Natally

1. *Effect on nipples.* Attempts to stimulate the growth of nipples with oestrogens have resulted in complete failure.

The most extreme cases of inverted nipples will, however, become everted after treatment by inunctions of 5% stilboestrol in arachis oil into the base of the nipples 4-6 times daily during the last 4 weeks of pregnancy. Weaker solutions of stilboestrol in arachis oil, and control inunctions of arachis oil alone, do not have the same effect.

2. *Effect on subsequent lactation of antenatal administration of oestrogens by mouth.* A series of patients was given 5 mg. of hexoestrol by mouth every 4 hours for 1-3 weeks before delivery. Where the subsequent labour was normal, the onset of lactation was not delayed, and the secretion of milk was often copious. Where operative interference was necessary, or where the labour was long and difficult, the onset of lactation was often delayed and the secretion scanty, sometimes being even absent.

Among the controls who had not had oestrogens antenatally, it was found that a higher percentage of deficient lactation occurred among women who had had uterine inertia, forceps-delivery, caesarean section or episiotomies. It would seem therefore, that it is not the oestrogens which delay the onset of lactation, but the difficult labour.

### b. Post-Natally

1. *Engorgement of the breasts.* The too-rapid onset of lactation at the 2nd or 3rd day of the puerperium causes engorgement of the breasts. It was found that this could be controlled by oestrogens. The breasts usually become engorged during the 2nd or 3rd night of the puerperium. This can be prevented by leaving a 5 mg. tablet of hexoestrol or stilboestrol beside the patient on the 2nd evening, and instructing her to take it with a tumbler of water as soon as she feels a sensation of tightness in her breasts. If the pill has been taken when the next feed is due, further 5 mg. tablets of hexoestrol or stilboestrol should be given after every breast-feed until the Sister or Medical Officer has seen the patient, and has decided that the risk of engorgement is past. Anything from 3 to 18 tablets may be necessary. It is better to err on the side of too many tablets than too few. This treatment does not suppress lactation, but keeps the milk flowing freely, and prevents failure in those women who have the ability to lactate normally. The infant should on no account be removed from the breast during this treatment.

2. *Lumpy breasts.* Lumpy breasts in the puerperium can be cured by 5 mg. tablets of stilboestrol or hexoestrol, or by 1 mg. tablets of dienoestrol. The tablets should be given with a tumbler of water after each breast-feed, i.e., every 3-4 hours, until the lumps have gone. The infant should not be removed from the breast during the treatment. The output of milk increases in those women who have the ability to produce milk. There is no change in output where the ability to produce milk is absent.

3. *Cracked nipples.* Five per cent. stilboestrol in arachis oil, rubbed into the crack, will heal it in a few days. Until

the crack is healed, the patient should wear glass shells, in order to keep the nipple dry, and to keep the clothes from sticking to the crack. The stilboestrol in oil must be washed off before each breast-feed, and re-applied afterwards. As much as possible must be rubbed into the tissues. If the surface of the nipple is left covered with oil, it is liable to give rise to a rash. Stilboestrol has been used by others, but the results do not appear to have been published. The healing-time was found to be much quicker than among the control cases.

4. *Lactorrhoea*. Lactorrhoea is common in the first weeks of lactation. If it is excessive and continues after the 3rd week of lactation, it may give rise to a superficial breast-abscess, or to failure of lactation. It is commonest among the sprinter class of milkers. It can be cured from the 4th week of lactation by giving the mother 5 mg. of hexoestrol or stilboestrol by mouth after every breast-feed over a period of 5-7 days. When cured it never seems to recur. It cannot be controlled during the puerperium, and most cases spontaneously recover in the 3rd week of lactation. If lactorrhoea and failing lactation are present together in the later weeks, treatment with oestrogens increases the milk-yield and seems to prevent subsequent failure. This treatment also prevents superficial breast-abscesses which start as a staphylococcal infection of the Montgomery follicles owing to the continual moistness of the skin of the areola.

5. *Threatened breast-abscesses of the deep glandular type*. This kind of abscess may occur from the 2nd week of lactation onward. The mother usually belongs to the sprinter class of milker. Hexoestrol (5 mg. every 4 hours) was found to cure the condition, provided treatment was commenced before the pressure inside the lobules had destroyed the cells. If the treatment is started within 1-2 days of the appearance of the lump, the condition can be cured in a few days. The temperature drops within 12 hours, and the lump becomes less painful, and finally vanishes. If the condition is more advanced when treatment is begun, it may be necessary to give the patient, every 4 or 3 hours, 5 mg. of hexoestrol for as long as 3 weeks. Hexoestrol does not produce in these women withdrawal-bleedings from the uterus. The infant should not be removed from the breast during treatment. Patients who have been cured show a tendency to recurrences. As many as 7 attacks have been noted in the same woman during the six months of her lactation.

Patients who belong to the sprinter class of milkers should be discouraged from expressing their milk after feeding the infant, as this leads to early failure. Instead, they should be provided with a box of 5 mg. tablets of hexoestrol, and be told to take one pill after each breast-feed, if they feel that their breasts have not been emptied by the infant. In this way breast-abscesses of the deep glandular type can be prevented.

Failure of lactation can be prevented in the sprinter class of milkers by discouraging expression of the breasts

after feeds, together with periodic short courses of oestrogens. So long as the infant is kept at the breast, oestrogens do not seem to suppress lactation. It seems to be the pressure inside the lobules that suppresses lactation, and in some way unknown at present the oestrogens can control this pressure, provided the cells of the lobule are living. Barnes<sup>3</sup> (1942) has noted how difficult it sometimes is to suppress lactation with oestrogens where the infant is not suckling. Arbarbanel (1939) doubts whether oestrogens do suppress lactation where the infant is suckling.

One week's course of oestrogens after each breast-feed can also be used to control the force with which the breast sprays the milk into the infant's mouth. Infants belonging to the sprinter class of mother can in this way be prevented from choking at the breast and from getting the "wind".

6. *Infantile mastitis*. Infantile mastitis sometimes becomes so advanced that incision is necessary. This can be prevented by applying 5% stilboestrol in arachis oil on lint to the infant's breasts, and leaving the lint in position for 24 or 48 hours. Then gentle pressure causes the milk to spray out, and the mastitis disappears and does not recur. The fluid expressed has been proved to be milk.

#### D. CONCLUSIONS

In conclusion it can be said that there are five classes of milkers among women, and that, at present, there are only two hormones which can be used for the treatment of hypogalactia.

1. *Stayers*. In these women the production of hormones is normal, and they successfully feed their infants without difficulty.

2. *Stickers and non-starters*. These women seem to be deficient in thyroid secretion, and therefore need intensive thyroid therapy in the puerperium in order to cause them to start lactating normally. Treatment after the 12th day of the puerperium has been found to be useless.

3. *Sprinters and abscess-producers*. These women need to be intermittently given oestrogens throughout the whole six months of lactation, in order to prevent breast-abscesses and early failure of lactation.

4. *Deformed and cracked nipples* can be cured by local inunctions of oestrogens.

5. An extract of the anterior-pituitary gland has not been found to increase milk-production in women suffering from hypogalactia.

6. Infantile mastitis can be cured by local application of oestrogens to the infant's breasts.

\* [See also article (BMB 1107) by Barnes in this number.—Ed.]

#### ACKNOWLEDGEMENTS

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## HORMONAL INHIBITION OF LACTATION

With Special Reference to Man

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One of the striking contributions of endocrinology to clinical obstetrics has been the use of hormones for the inhibition of lactation. Before the discovery of these specific substances the standard method consisted in binding the breasts, restricting fluid-intake and administering saline aperients. In spite of these measures, which have obvious disadvantages for the puerperal woman, the patient would often have to endure painful engorged breasts for several days. The symptoms might be so severe as to necessitate the administration of analgesic drugs.

Endocrine control of lactation has been dealt with elsewhere<sup>1</sup> in this series (Folley, 1947a, 1947b).

### Oestrogens

On the basis of experimental findings, it was suggested that oestrogenic hormones might be used for the inhibition of lactation in puerperal women. This suggestion appears to have been first made by Sawizki (1935). Hoffmann (1937) claimed that lactation could be inhibited in women by the use of follicular hormone. Foss & Phillips (1938) obtained satisfactory results in 62 cases with oestradiol benzoate, giving a total dose of 10,000 international units. They found that oestrogens were also useful for flushed and engorged breasts, relieving the symptoms without interfering with lactation. Lehmann (1938) used oestradiol benzoate and found that 100,000 international units given by injection in the first 24 hours post partum inhibited lactation in 91% of cases. Inhibition of established lactation was obtained in 89% of cases with 200,000 units, but in only 50% with 150,000. Jeffcoate (1939) gave oestrone by mouth in doses of 2-6 mg., gradually decreasing the dose over 1-3 days. He found that it was usually necessary to supplement this by 1-2 mg. of oestradiol benzoate by injection. Adrian (1938) used 20,000 international units by injection, repeating the dose up to a total of 60,000 units. Pain and tension in the breasts were relieved, but in 43% of cases there was slight secretion of milk. Ramos & Colombo (1938) also showed that lactation could be successfully inhibited by naturally-occurring oestrogenic hormone.

Since the discovery of the synthetic oestrogens it has been shown that these substances are capable of reproducing the biological and clinical effects of the naturally-occurring oestrogens. They can be produced relatively cheaply and are in most cases as potent, if not more so, when given by mouth as when injected. Thus, they stand in contrast to the naturally-occurring oestrogens, which are generally very much less potent by mouth and are therefore best administered parenterally.

In view of the success achieved with naturally-occurring oestrogens, it was obvious that synthetic oestrogens were likely to prove useful for the inhibition of lactation. Reports of success with stilboestrol appeared from Winterton & MacGregor (1939) and from Wenner & Joël (1939). Mucklé (1940), using stilboestrol, found that though initial success was achieved with 5 mg. given three times daily, the breasts filled in 40 % of his cases in 4-5 days and further treatment was necessary. Mendel, Goldman & Caire (1941) also claimed satisfactory results with stilboestrol.

Stewart & Pratt (1941) suggested that inhibition of breast-engorgement is not synonymous with inhibition of lactation. Stilboestrol, natural oestrogens and testosterone may all be used to prevent engorgement. Lactation may be diminished temporarily with stilboestrol, though individuals vary in this respect. A negligible effect on lactation was noted with 250,000 international units of oestrone and 125 mg. of testosterone.

Abarbanel & Goodfriend (1940) discovered, in a study of 315 lactating women, that doses of up to 1,000 mg. of stilboestrol were well tolerated. They also found that stilboestrol did not inhibit the onset of lactation and, in doses of 500 mg., did not inhibit established lactation provided that the stimulus of suckling was present.

Connally, Dann, Reese & Douglass (1940) studied the effect of stilboestrol in 200 puerperal women, finding no toxic effects even with large doses. They found that the onset of normal lactation was delayed in cases receiving stilboestrol, but that there were no cases of engorged or painful breasts among their patients.

Abarbanel & Klein (1941) gave stilboestrol to three groups each of 50 puerperal women. In the first group, which consisted of normally-lactating women, no effect was noted. In the second group stilboestrol was given 3-10 days post partum, and it was found that the onset of lactation was not affected, provided that the infant was suckling. In the third group, consisting of women who were not suckling, it was found that stilboestrol prevented painful breasts in 87 %.

Thus, by the end of 1941 it was established that substances with oestrogenic properties, whether naturally occurring or synthetic, could be used for the inhibition of lactation and for the prevention and treatment of breast-engorgement. At this time an investigation to test the effects of the new synthetic oestrogen dienestrol was carried out by the present author (Barnes, 1942). It was decided to try the effect of the new substance for the inhibition of lactation, comparing it with stilboestrol and hexoestrol, in order to test the relative potency of the three substances. Trials were carried out in 134 cases, 81 receiving stilboestrol, 37 dienestrol and 16 hexoestrol. Ultimate success with regard to lactation was obtained in all cases, though in about a quarter it was necessary to repeat the five-day course of treatment, as the breasts filled up after discontinuing treatment. The dosage was varied in an endeavour to find an optimum. Most of the patients received stilboestrol, a total dosage of 30 mg. usually

<sup>1</sup> [See *BMB* 1100, 1101.—Ed.]

being given, starting with 5 mg. twice daily and gradually diminishing the dose down to 1 mg. twice daily. Dienoestrol was used with caution and in much smaller doses than stilboestrol and hexoestrol. This was because diennoestrol was being used clinically for the first time. Experimental work with mice by Emmens (1938) had suggested that diennoestrol was at least ten times as potent as stilboestrol when given by mouth. Also it was not certain that diennoestrol was free from harmful effects.

It must be emphasized that even in cases where complete success was not achieved, that is in 60 out of the 134 patients, the symptoms complained of amounted to no more than a slight fullness of the breasts or temporary leakage of milk. Results were better when treatment was begun within one day of delivery than when it was started later. They were also better in patients in whom pregnancy had advanced beyond the 32nd week than in those where termination had occurred in the earlier months. No toxic effects were noted, apart from transient nausea in 3 patients.

It was impossible to give more than a vague idea regarding the relative potency of the three substances, since the series was too small and thus opportunities for varying dosage were too limited. It was suggested that stilboestrol was more potent than hexoestrol, and that diennoestrol was more potent than either. The latter result has not been confirmed by subsequent work by others, using diennoestrol for other purposes, and it is now suggested that diennoestrol is three times less potent than stilboestrol. Nevertheless, the value of these three synthetic oestrogens for the inhibition of lactation is now established.

Triphenylchloroethylene, another synthetic oestrogen, was also used in my series in a few cases. Macpherson & Robertson (1939) first demonstrated the oestrogenic properties of this substance and showed that it could be used for the inhibition of lactation. Moir (1942) reported a series of nearly 50 cases where triphenylchloroethylene was used for the inhibition of lactation. The dose used was one tablet of 500 mg. twice daily for 4 days, followed by one tablet daily for 3 days. A test of 250 mg. in a single injection in oil was not successful, but in the cases where the substance was given by mouth there were no failures. Moir concluded that the question of the ideal oestrogen for the inhibition of lactation may be largely one of the relative cost of the different products.

Kurzrok, Birnberg & Livingston (1942) gave ethinyl oestradiol by mouth to 59 puerperal women for 3-4 days. Doses of less than 1.5 mg. daily gave only moderate results, but with 1.5 to 2.4 mg. daily for 3-4 days, results were excellent.

Diddle, Nagyfy & Sells (1942) compared the effect on breast-engorgement of  $\alpha$ -oestradiol in propylene glycol with that of stilboestrol. Comparable total dosage of the two drugs gave similar results, but  $\alpha$ -oestradiol had to be given more frequently and was more expensive than stilboestrol.

Murphy (1943) used octofollin in 25 women for inhibition of lactation, giving 5 mg. three times daily for the first 4 postpartum days. Results were excellent and no toxic effects were observed.

Four further papers giving the results of the use of stilboestrol for the inhibition of lactation appeared in 1944 and 1945. Walsh & Stromme (1944) obtained excellent results in 190 cases, with controls, finding that 20 mg. of stilboestrol given in a diminishing dosage for three days gave striking relief of pain and engorgement as compared with controls. The effect was slight once lactation was established. Meek & Murby (1944) compared the effects of stilboestrol and natural

oestrogen on two series each of 30 cases. Both were found to be efficient and well tolerated, but the effect was slight once lactation was established. Brown & Grant (1944) gave stilboestrol and tablets containing a placebo to alternate women who were normally suckling. The authors found that stilboestrol was well tolerated and did decrease breast-engorgement, but at the expense of lactation. Fields (1945) found that stilboestrol was effective in aiding cessation of lactation, but depressed milk-secretion, in spite of suckling, when given to normally-lactating women.

Prescott & Basden (1944) found that a single intramuscular injection of 12.5 mg. of hexoestrol dipropionate, given in the first 3 postpartum days, was effective in inhibiting lactation in 66 % of a series of 44 mothers. Further treatment was needed in only 34 %, and secondary filling occurred in only 7 %. The authors claim that their results compare favourably with those of other workers who gave oestrogens by mouth, and state that in their experience oral treatment was less successful than treatment by injection.

To sum up, it may be said that any substance which has oestrogenic properties may be used for inhibiting lactation. The question of the choice of oestrogen may eventually prove to be largely one of cost. Synthetic oestrogens have the advantage of cheapness and are also easily given by mouth.

#### Testosterone

It has been shown experimentally that testosterone inhibits lactation, and clinical trials have shown that this substance may also be used for inhibition of lactation in puerperal women.

Kurzrok & O'Connell (1938), Birnberg, Kurzrok & Klor (1940) and Siegler & Silverstein (1940) all used testosterone propionate for this purpose. All obtained good results, and Siegler & Silverstein considered that testosterone is better for the inhibition of lactation than stilboestrol, claiming that stilboestrol causes afterpains and excessive lochia. This does not appear to be the experience of other workers who have used stilboestrol, and the results with testosterone do not appear to be as good as those with stilboestrol. Better results were obtained by Abarbanel (1939), who gave testosterone propionate in doses of 10 mg.-5 mg. intra-muscularly and, one hour later, 5 mg. subcutaneously. He found complete relief of breast-pain in 92 % of 50 patients, but found that, provided suckling was continued, there was no effect on lactation.

Kushner (1942) gave 25 patients methyl testosterone by mouth in doses of 30 mg. three times daily for 3 days, a total dosage of 270 mg. Success in the form of complete inhibition of lactation was obtained in 23 cases. Kushner recommends methyl testosterone by mouth as a substitute for testosterone propionate administered by injection, or percutaneously, for postpartum inhibition of lactation.

Lass (1942) also used methyl testosterone orally, giving 250-300 mg. in divided doses over a period of 36 hours, beginning 36 hours after delivery. He found that the course of the puerperium was unaffected and that patients were more comfortable than when older methods were used.

Duckman & Turino (1942) used testosterone, giving 150 mg. in 5 doses of 30 mg., beginning on the 4th postpartum day. Good results were obtained in 88 % of cases.

Diddle (1941) compared the use of stilboestrol and testosterone propionate for the inhibition of lactation. Good results were obtained with both substances, though two

patients who were receiving stilboestrol exhibited toxic effects. The dosage of testosterone propionate, 25 mg. on 3 alternate days, or a total of 75 mg., was smaller than that used by other workers.

Jeppson, Kasabach & Kanter (1942) studied the effects of testosterone propionate on lactation and found it of little value in preventing breast-engorgement. It was found to delay and depress lactation. For inhibition of lactation they found little to choose between testosterone propionate and stilboestrol.

It may be concluded that though testosterone may be successfully used for the inhibition of lactation, it has no special advantage over the oestrogens and is much more expensive. Testosterone propionate has the additional disadvantage of requiring parenteral administration.

### Discussion

That the administration of appropriate hormones, or their synthetic analogues, does inhibit lactation, or at least prevent painful engorgement of the breasts in non-lactating, puerperal women, is an undoubted clinical fact. The mechanism of this remains obscure, the more so because it is known that oestrogenic hormone may exert both mam-mogenic and lactopoetic effects, at least in certain animals. Abarbanel (1941) suggested that painful engorgement of the breasts and lactation are not synonymous, though they may occur simultaneously.

Certain experimental observations may be quoted, though they throw little light on the general problem. Hamilton (1937) claimed that testosterone causes inhibition of the hypophysis, with histological degeneration. Reece & Mixner (1939) showed that administration of testosterone increased the lactogenic-hormone content of the anterior pituitary. They injected testosterone daily for 15 days into sexually-mature, spayed female rats. The lactogen content of the pituitary increased by 40 %, and there was extensive development of the lobular-alveolar system, this effect occurring apparently through the anterior pituitary. Mixner & Turner (1942) showed that progesterone, desoxy-corticosterone-acetate, dehydroandrosterone, stilboestrol, acetoxyprogesterone and methyl testosterone all stimulate growth of the mammary-alveolar system, while testosterone and testosterone propionate do not. Meites & Turner (1942a) suggested that the decrease in lactation due to natural oestrogens, stilboestrol and testosterone propionate was due to decrease in the secretion of anterior-pituitary hormones other than lactogenic hormone. It was suggested that these hormones were in some way essential for milk-secretion. The same authors (Meites & Turner, 1942b) showed that progesterone had no effect in the guinea-pig on the lactogen content of the pituitary, but that oestrogenic hormones increased pituitary lactogen. Meites & Turner (1942c) suggest that progesterone falls first, just before parturition, and gives ascendancy to oestrogen, which stimulates the production of lactogenic hormone. This does not seem a very convincing explanation of what is undoubtedly a complex mechanism, and further work seems necessary to clarify the position.

The clinical facts are, however, proved without question and only two further points require discussion. First, are hormones given in the puerperium in any way harmful and, secondly, which is the best preparation for clinical use?

The effect of hormones on puerperal women was studied by Rutherford (1942). He studied three groups, each of 12 patients. One group was taken as a control. The second received 10 mg. stilboestrol daily for 12 days. The third group received 10 mg. methyl testosterone orally for the first 12 days. He claimed that involution was delayed by stilboestrol and not by methyl testosterone. Endometrial biopsy showed that repair of the endometrium was hastened by stilboestrol, but delayed by methyl testosterone. Regeneration of the epithelium, but not of the stroma, was hastened by stilboestrol but delayed by methyl testosterone. The myometrium was unaffected. The effect of stilboestrol was lost within one week, and that of testosterone within three weeks after withdrawal. Thus, apart from the delay in involution, always an extremely difficult matter to assess accurately and therefore open to question, there was no evidence of any harmful effect.

Connally (1943) studied the effect of stilboestrol on puerperal women. He claimed that it tended to reduce the incidence of postpartum pyrexia, possibly due to the increased vascularity of the uterus, or to an effect on the myometrium, or to rapid regeneration or to alteration in vaginal pH. He found that suppression of lactation tends to occur and concludes that this precludes the routine employment of stilboestrol in the puerperium. Pregnant and puerperal women tolerate large doses of stilboestrol, such as would cause toxic symptoms in the non-pregnant. Bromberg (1942) emphasized this fact. He found no effect from 275-445 mg. of stilboestrol, while other workers have given as much as 1,000 mg. without any signs of toxicity. Bromberg concludes that pregnant women must detoxicate stilboestrol in some way, since one of his patients who showed no toxic reactions when pregnant, reacted when not pregnant to a dose of only 2-5 mg.

The value and safety of hormones for inhibition of lactation seems proven. There remains only the choice of the best preparation. Here the synthetic oestrogens have the advantage of cheapness and of ease of administration. Stilboestrol was the first of these to come into general clinical use and is probably today the most widely used. Given in gradually diminishing doses over a 5-6 day period after parturition, it gives satisfactory results in a high proportion of cases, though treatment may need to be repeated. The alternative is to give an initial large dose of a synthetic oestrogen, such as hexoestrol dipropionate in oil, by injection. This has presumably a similar effect, as absorption takes place in gradually diminishing amounts over a period of 4-5 days. This may present some advantages over the twice-daily administration of tablets, though repetition of treatment may become necessary.

Whatever method is employed, success is assured in the majority of cases, and the use of hormones represents a real advance on the methods of treatment formerly employed.

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## A SURVEY OF THE PLACE OF COW'S MILK IN THE HUMAN DIET AND OF THE EFFECT OF PROCESSING ON ITS NUTRITIVE VALUE

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- 1 Importance of milk in satisfying dietary requirements
- 2 Milk-fat
- 3 Milk as a dietary supplement
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Ever since the dawn of history when man first domesticated animals he has been in the custom of using their milk for food. It is significant that the carnivorous dog, probably the first animal to be tamed, was never

used for this purpose; the milch animals are, with the historic exception of the nurse of Romulus and Remus, herbivorous and, but for the mare and female ass, all ruminants. This may have been largely a question of convenience and economics, as the animals kept for meat and milk did not compete with man for food, and converted into valuable foodstuffs plant-matter otherwise of little use to him. Their nutritional requirements are very different from those of men, and ruminants especially derive from the symbiotic activities of the paunch-flora essential factors which man can obtain only from the diet. The rate of development of their young also differs from that of the child. For these reasons the composition of human milk, best adapted to promote the growth of the baby, is dissimilar in many respects to that of the cow, specially suited for the nutrition of the calf. It nevertheless remains broadly true that cow's milk is probably the most perfect single food of man.

In this connexion there has been much loose thinking about the merits of cow's milk, more particularly in Britain, and there has arisen a legend crediting nature with having specifically designed this fluid for the benefit of the human race. According to this legend, any interference with the "natural state" of the milk as it leaves the udder is harmful, and its devotees condemn any form of heat-treatment and the associated evils of milk-processing. The balance of scientific proof is heavily against such views. Milk is a great improver of diets but, as will be shown later, there is no evidence to indicate that properly executed heat-treatment makes it less suitable for this purpose. Every form of processing affects to some degree one or the other of the more labile constituents of milk, but on the whole the changes are not serious. Moreover, cow's milk is only quite exceptionally taken by itself. It cannot therefore be considered on its own

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in a nutritional vacuum, but as a constituent, albeit very important, of the mixture of foods forming the normal diet of young, adult and old.

### 1. Importance of milk in satisfying dietary requirements

Milk is a variable product and its composition depends on many factors such as the breed of the cow, her feeding and health, the season of the year and the stage of lactation. A single set of figures such as is quoted in table I can serve only to illustrate its broad nutritive characteristics.

TABLE I. AVERAGE COMPOSITION OF 100 g. OF SUMMER MILK

Major constituents		Minerals	Vitamins	
Water	87.6 g.	Calcium 0.12 g.	A	150 international units
Total solids	12.4 g.	Phosphorus 0.10 g.	Carotene	
Protein	3.3 g.	Magnesium 0.01 g.	B <sub>1</sub>	45 µg.
Fat	3.6 g.	Iron 0.03 g.	Riboflavin	150 µg.
Carbohydrate	4.7 g.		Nicotinic acid	80 µg.
Calories	66		B <sub>6</sub>	70 µg.
			Biotin	2.5 µg.
			Pantothenic acid	250 µg.
			Inositol	18 mg.
			C	2 mg.
			D	2 international units

Man has developed successful dietary patterns from which milk is almost entirely excluded but, on the whole, superior physique and the mental attributes associated with robust health are more commonly found in those civilizations where it is plentifully used. Significantly, too, in communities whose food contains little or no milk, especially in the more primitive though healthier communities, breast-feeding is often prolonged into the second and even third year of the child's life.

It is generally agreed that the importance of milk as food is due mainly to its content of protein of high biological value, its exceptional richness in calcium, and its generous supply of preformed vitamin A, and of riboflavin and other members of the vitamin B complex. The characteristic carbohydrate, milk-sugar, doubtless exerts a beneficial effect on the flora and hydrogen-ion concentration of the gut of children and probably of adults. The large amount of finely-dispersed and well-assimilable fat is a further asset.

The nutritional contribution of milk may be expressed in terms of dietary requirements. Several such yardsticks have been put forward in recent years by various authorities, the latest being that of the United States National Research Council (1945). This body has listed recommended allowances for various physiological classes. It can be calculated that one pint<sup>1</sup> of milk of the composition quoted in table I supplies seven-eighths of the calcium,

over one-quarter of the protein (including one-half of the animal protein), slightly more than two-fifths of the riboflavin, just under one-fifth of vitamin B<sub>1</sub> and of the vitamin A, and one-eighth of the energy recommended for a moderately active man. A similar calculation shows that a five-year-old child can obtain from one pint of milk one-quarter of its daily needs of energy, little less than one-half of the protein (including almost all the animal protein), nearly three-quarters of the calcium, one-third of vitamin A and vitamin B<sub>1</sub>, and three-quarters of the riboflavin allowance. It will be seen that the contribution to the needs of the child is not only larger but more evenly distributed, indicating the special value of milk for the young. It should be remembered that the American recommendations are set very high, and that lower standards, especially for certain vitamins, are doubtless compatible with adult health, and have, in fact, been officially used in Britain (Combined Food Board, 1944).

Other protective foods, notably eggs and liver, are in some respects equal or superior to milk, yet none of them achieves that balance of nutritive properties which makes the latter probably the most valuable single food of man. For one thing, apart from its high content of valuable nutrients, milk is also consumed, or potentially available, in larger quantities; though it contains for example much less riboflavin than an equal weight of liver, it is in the USA the most important single source of this factor (Cheldelin & Williams, 1943). The supply of milk, and of eggs for that matter, is much more elastic than that of liver; it takes one ox to provide one liver.

The position is similar with vitamin A. Liver is much richer in it than milk, yet milk is by far the more important source. According to Virtanen (1938), milk and milk-products are the main sources of vitamin A in Finnish diets in late winter and spring and determine largely the adequacy of the vitamin-A content of the diet.

The concentration of vitamin B<sub>1</sub> in milk is moderate, and it is perhaps surprising that, before the introduction of enriched bread, it was in the USA the second best source of this vitamin in the diet (Lane, Johnson & Williams, 1942).

As a source of vitamin C, milk is seldom considered at all, yet the amount of vitamin C originally secreted into it is, in the USA, equal to that supplied by the citrus crop of that country (Sharp, Guthrie & Hand, 1940). Even in Britain, the 1,000 million gallons drunk every year could supply the consumers with 90 tons of ascorbic acid. In fact, owing to the effect of exposure to light (Kon & Watson, 1936) and of handling (Sharp *et al.* 1940; Mawson & Kon, 1945) only a fraction of these amounts is present in the milk as it reaches the table.

### 2. Milk-Fat

A lively controversy, almost entirely based on experiments with rats, has recently been going on about the nutritive value of milk-fat, for which superiority over other edible fats was claimed by some workers and denied by others (the literature up to 1945 is reviewed by Henry, Kon, Hilditch & Meara, 1945; cf. also Cowgill, 1945). The latest suggestion is that vaccenic acid, an isomeride of oleic acid, is responsible for the superiority of butter (Boer, Jansen & Kentie, 1946; Brouwer & Jonker-Scheffener, 1946), but the chemical and biological proof

<sup>1</sup> [1 pint = 0.568 L.—Ed.]



is not yet entirely convincing. Whether these supposed special properties of milk-fat, even if finally proven, are likely to be of importance in human nutrition is, to say the least, doubtful (Council on Foods and Nutrition, 1942).

Quite apart from modern considerations of nutritive value, cream has proverbially and since time immemorial been regarded as the most valuable part of milk, and milk from which the fat has been removed has borne a stigma of inferiority. This prejudice still persists but in fact skim milk, so convenient to use in the dry form, is a most valuable food, deprived it is true of vitamin A by the removal of fat, but with all other nutritionally-important constituents of milk proportionately increased. It is naturally unsuitable as a food for babies, and in Britain it must be clearly labelled as unsuitable.

### 3. Milk as a Dietary Supplement

Except by the artificially-fed baby, cow's milk is seldom taken alone, and it is in its ability to supplement other foods in a mixed diet that its chief value lies. It blends, for example, most efficiently with such staple foods as cereals and potatoes. It may truly be said that on this property of milk to improve and ennoble other foods, to add to them various essentials, rests the foundation of the modern knowledge of nutrition forged in the laboratories of Hopkins, of Osborne and Mendel, and of McCollum. Even though one should be cautious in reasoning from mice to men, one cannot help being impressed by the results of Campbell & Sherman (1945), who raised 59 generations of rats in health and vigour on a diet consisting solely of a mixture of five parts whole wheat and one part dried milk with some table-salt, and distilled water to drink.

This enhancing effect is largely due to the contribution of calcium, vitamin A, and vitamins of the B<sub>2</sub> complex, and also to the marked supplementary relationship between the proteins of milk and those of other foods (cf. Mitchell & Hamilton, 1929; Block & Mitchell, 1946).

It may prove useful to consider at this stage the changes in the nutritive value of milk caused by the various commercial methods of preservation, and to examine then how milk in its several forms fits into the patterns of human nutrition.

### 4. Pasteurized Milk

This process, in which pathogenic, and most other, organisms are killed by the application of heat well below the boiling-point of water, is usually done by the holder or by the High-Temperature : Short-Time (HTST) method. In the former, the milk is held for ½-hour at 145-150°F,\* in the latter for a matter of seconds only at a temperature of not less than 162°F. Exhaustive experiments carried out some 10 years ago in Britain (Milk Nutrition Committee, 1937; Houston, Kon & Thompson, 1940) and since largely confirmed (cf. reviews by Kon, 1938b, 1940, 1943) have shown that in holder-pasteurization there is a loss of some 10% of vitamin B<sub>1</sub> and 20% of vitamin C, but no loss of riboflavin or of vitamin A and carotene. The availability of calcium and the biological value and digestibility of the milk-proteins are also not

affected. More recently Hodson (1944, 1945) and Lawrence, Herrington & Maynard (1946) found that nicotinic acid, biotin and pantothenic acid also survive pasteurization without loss. There are, on the other hand, indications that vitamin E is affected (Anderson, Elvehjem & Gonce, 1940). It may be added that calf-feeding experiments carried out in Britain (Milk Nutrition Committee, 1938b) did not disclose any significant effects of holder-pasteurization on the nutritive value of milk.

The treatment is not alone to blame for the damage to vitamin C; milk which had never been exposed to light or contaminated with copper is unaffected. It is only the more labile form of the vitamin, reversibly oxidized under the action of light, which is destroyed, while reduced ascorbic acid itself, the form in which the vitamin is secreted by the normal cow, is not altered (Kon & Watson, 1936).

In a study of the vitamin-C content of milk as consumed, Mawson & Kon (1945) found that on reaching the table pasteurized milk had only one-half of the amount of vitamin C present at this stage in raw milk. There is little doubt that this difference was only partly due to heat-treatment itself; the pasteurized milk was probably handled more than the raw and, because of better keeping-quality, was delivered less promptly.

Riboflavin is also affected by light: in fact, it is the substance that sensitizes ascorbic acid to photo-oxidation (Hopkins, 1937, 1938; Hand, Guthrie & Sharp, 1938). Exposure of milk to sunshine in pint or two-pint delivery-bottles may cause serious losses of this vitamin (Peterson, Haig & Shaw, 1944; Ziegler, 1944).

It is generally agreed that the HTST method of pasteurization is even less injurious than the holder method, though most of the evidence rests on the measurement of vitamin C only (cf. Kon 1940, 1943; Mawson & Kon, 1945). Holmes, Lindquist, Jones & Wertz (1945) compared the two methods directly and found no loss in the former of riboflavin, vitamin B<sub>1</sub> and vitamin C; with the latter, 18% of vitamin C and 9-20% of vitamin B<sub>1</sub> was lost. With a method of HTST pasteurization during which milk was to some extent exposed to light, Ziegler & Keevil (1944) observed losses of riboflavin amounting to 9-16%.

### 5. Sterilized Milk

Sterilized milk is popular in some large British towns, especially London and in the Midlands, because of its excellent keeping-quality. A study of this milk at Shinfield (Kon & Henry, 1938; Henry & Kon, 1938a, 1938b, 1938c; Henry, Ikin & Kon, 1938a, 1938b; Gillam, Henry, Kon & White, 1938; Kon, 1938a; Houston *et al.* 1940) showed that the drastic heat-treatment destroys about half the vitamin C and 30-50% of vitamin B<sub>1</sub>, and that the biological value of the proteins is also affected, though to only a slight extent.

### 6. Condensed Milk

The kind of condensed milk generally known as "evaporated" is sterilized by heat at a temperature of 240°F. after partial removal *in vacuo* of the water, whereas in sweetened condensed milk bacteriological purity is achieved by the addition of cane-sugar which checks bacterial growth, and exposure to high temperatures is

\* [°F. = 5/9(t-32)°C.—Ed.]

avoided. It is clear that the processing of the unsweetened milk is more injurious to the labile nutritive factors than the manufacture of the sweetened variety. Evaporated milk loses some 60 % of the vitamin C and 30-50 % of the vitamin B<sub>1</sub> originally present (Henry, Houston, Kon & Osborne, 1939; Henry, Houston, Kon & Thompson, 1944); vitamin B<sub>6</sub>, nicotinic acid, pantothenic acid, choline and biotin are, however, not affected (Hodson, 1944, 1945).

In contrast, sweetened condensed milk may contain only some 10 % less vitamin C and 5 % less vitamin B<sub>1</sub> than the equivalent quantity of raw milk from which it was made (Henry *et al.* 1944). It is of interest that as long as 25 years ago Hume (1921) noticed that sweetened condensed milk was a good source of vitamin C.

Tins of condensed milk will keep for an appreciable time, though the palatability gradually deteriorates and vitamins C and B<sub>1</sub> suffer progressive loss (Henry *et al.* 1939, 1944; Knott, 1942). It should be pointed out that as sweetened condensed skim milk may be highly dangerous if wrongly used. The unscrupulous sale in the tropics of this product, "ideal for producing in bottle-fed infants a vitamin A deficiency" (Meulemans & de Haas, 1938), has led to many tragedies; it was responsible for two-thirds of all cases of xerophthalmia observed in a Batavia hospital in infants up to 2 years of age (de Haas, Posthuma & Meulemans, 1940).

## 7. Dried Milk

The two main methods of preparing milk as free from water as possible are spray- and roller-drying. With high-class products there is not much to choose nutritionally between these two processes, and their effects are no more detrimental than those of holder-pasteurization with the exception that the biological value of the proteins is slightly reduced by the drying (Henry *et al.* 1939; Fairbanks & Mitchell, 1935). Full-cream dried milks deteriorate rapidly on storage in the presence of air, because of oxidative changes in the fat, but they can be kept for a long time hermetically sealed in an atmosphere of inert gas such as nitrogen or carbon dioxide. If, however, the temperature to which milk is preheated before drying is raised from the usual 165°F. to 190°F., powders so produced are much more resistant to oxidation when exposed to air because of the formation of sulphhydryl compounds which act as antioxidants, and the more complete destruction of oxidizing enzymes. The higher temperature of preheating is no more deleterious to the labile vitamins than the lower one, the stability on storage in air- or gas-pack of vitamin A and carotenoids and of vitamin C is enhanced, and the keeping-quality of the gas-packed milk is remarkable (Mattick, Hiscox, Crossley, Lea, Findlay, Smith, Thompson, Kon & Egdell, 1945). The biological value of the proteins of dried milk preheated to 190°F. does not differ from that of milk dried after preheating to the lower temperature (Henry & Kon, 1947b).

Dried skim milk is much less prone to oxidative changes and can be stored in the presence of air for long periods of time without loss of nutritive value, provided that its moisture-content is below 3 %. If this is higher, the biological value of the proteins deteriorates, as lysine gradually becomes unavailable by combining with lactose (Henry, Kon, Lea, Smith & White, 1946).

The concentrated stable forms of milk are usually manufactured when cows are on pasture and milk is plentiful. Despite some losses caused by the treatment, such milk may actually be nutritionally superior to fresh winter-milk from stall-fed cows. In general it may be said that the normally-occurring fluctuations in the compositional quality of milk exceed in magnitude the changes due to properly executed heat-treatment.

## 8. Observations and Experiments with Children

There is much evidence in human nutrition of the value of milk as an improver of diets, especially for children, and only a few examples can be quoted here. Naturally, the poorer the original diet, the more obvious the beneficial effect. For example, the addition of 1 quart (american, 946 ml.) of milk to the diet of negro children in an orphanage in which severe malnutrition existed was followed by spectacular improvement of the milk-drinkers, and later, of the control children when they were also given the benefit of the addition (McCollum, 1924). Aykroyd, Krishnan & Madhava (1937) and Krishnan & Mitra (1938) obtained statistically-significant improvements in height and weight and marked improvements in general condition in relatively small groups of children receiving in addition to a typical south-indian diet the equivalent of 1 ounce<sup>3</sup> of dried skim milk daily, when compared with similar groups of children receiving a supplement of equal caloric value of millet or of ordinary biscuit. Equally striking evidence is available from New Zealand with Maori children (Turbott & Roland, 1931), Japan (cf. Kon, 1934), Malaya (Scharff & Sinnadorai, 1937), the Philippine Islands (Concepcion & Paulino, 1938, Bulatao, 1938), the Nyasaland Protectorate (1938) and North Borneo (cf. *Nutr. Abstr. Rev.* 1939, 8, 839).

Probably the most detailed experiments on the value of milk for the growing child have been carried out in Britain. Some of them were planned to investigate the nutritive effects of heat-treatment, a problem which attracted here much attention. Corry Mann (1939) has recently reviewed the results of his early work done over 35 years ago on the addition of milk to the diet of children in poor circumstances living in institutions. In one comparison, twenty children receiving the institutional diet alone gained in 12 months 3.75 pounds<sup>4</sup> in weight and 1½ inch<sup>5</sup> in height, while the corresponding gains for twenty children who received a daily addition of 2 pints of raw milk were 5.5 pounds and 2½ inches respectively. At that time the bacteriological quality of the milk was very low, and there were many instances of milk-borne infection among the children receiving it. In another similar experiment, twenty control children gained 3.65 pounds and 1½ inches and twenty children given in addition 1 pint of flash-pasteurized milk showed increments of 5.75 pounds and 2½ inches. No infective disturbances were observed on this occasion.

Ten years later, Corry Mann (1926) carried out further experiments in a colony of boys in the vicinity of London, and with groups of 20-40 children found that the addition to the diet of 1 pint of milk produced better gains in weight and height during one year than equicaloric

<sup>3</sup> 1 ounce = 28 g.—Ed.]

<sup>4</sup> 1 pound = 0.454 kg.—Ed.]

<sup>5</sup> 1 inch = 2.54 cm.—Ed.]

supplements of vegetables, margarine, butter and sugar or additions of watercress and casein.

A few years later, large-scale experiments with over a thousand children were carried out in Scotland under the aegis of the Scottish Board of Health (Orr, 1928; Leighton & Clark, 1929). In each of seven centres, four groups of schoolchildren were selected to receive (a) whole milk, (b) separated milk, (c) a biscuit ration of the same caloric value as the separated milk, and (d) no addition to their usual diet. The quantity of milk varied from  $\frac{3}{4}$  to 1 pint according to age. The experiments lasted 2 years, and showed the superiority of the diets supplemented with the two kinds of milk over the other two treatments. There was no indication of any marked superiority of the whole-milk supplement over the addition of separated milk.

Later still Leighton & McKinlay (1930) carried out, also in Scotland, their well-known experiments. For 4 months in certain schools in Lanarkshire, 5,000 children were given daily  $\frac{3}{4}$  pint of raw milk, and 5,000 children in these same schools were used as controls. In a different set of schools 5,000 children received  $\frac{3}{4}$  pint of milk from the same source but pasteurized, and another 5,000 in these schools acted as controls. The conclusion of the authors that, while their experiment had demonstrated the beneficial effect of the addition of milk, it had shown no difference in this respect between raw and pasteurized milk, was challenged by Bartlett (1931) and Fisher & Bartlett (1931), examined critically by "Student" (1931) and supported by Elderton (1933); "Student", however, expressed doubts as to the validity of her evidence (cf. Kon, 1934). It seems safe to conclude that the value of milk to growing children was definitely proved, but that the original defect of the experiment, the trying of the two milks in different schools which may not have been chosen at random, makes it impossible to decide whether there was any difference between raw and pasteurized milk.

A few years later, another large-scale experiment was planned by the Milk Nutrition Committee (1938a, 1939). 8,000 schoolchildren from Luton, Wolverhampton, Huddersfield, Burton and Renfrewshire were randomly divided into four groups: a control group receiving a small amount of biscuit as a *placebo*, another group receiving  $\frac{1}{2}$  pint of pasteurized milk, and two groups receiving respectively  $\frac{3}{4}$  pint of raw and of pasteurized milk. The treated milk was from the same bulk as the raw. The observation lasted one year, and 6,000 children were present at all medical examinations. It was found that the supplements of milk brought about definite improvement in physique, in general appearance and in scholastic ability and, to a lesser extent, in muscular strength. Two-thirds of a pint produced more marked effects than  $\frac{1}{2}$  pint, but the differences between raw and pasteurized milk were negligible.

It is noteworthy that the effects of the additions of milk have been progressively less striking in the succeeding tests just described. It seems likely that the undoubted general improvement in the diet of the people was mainly responsible for this change. The improvement meant not only that the diets were on the whole more adequate, but that they contained more milk, and it stands to reason that by the law of diminishing returns further additions of milk produced less effect.

Quotations from the vast body of evidence on the value of milk in the nutrition of the child can be multiplied almost

at will. The findings in Britain are fully confirmed by American experience. Of the numerous studies there those of Lininger (1933) and of Roberts, Blair, Lenning & Scott (1938), MacNair & Roberts (1938) and Roberts, Englebrecht, Blair, Williams & Scott (1938) may be quoted as examples.

## 9. Specific Effects on the Child

Evidence is also available of more specific effects of milk in the diet of the growing child, especially its intimate connexion, at any rate with dietaries of the European type, with the building of bone (Sherman & Hawley, 1922; Outhouse, Kinsman, Sheldon, Twomey, Smith & Mitchell, 1939; Kinsman, Sheldon, Jensen, Bernds, Outhouse & Mitchell, 1939; Macy, 1942), and with the development of normal teeth resistant to caries (Mellanby, 1934).

While laboratory experiments have shown that the effects of properly performed heat-treatment are not on the whole severe, experiments and observations with children make it clear that in practical nutrition the changes, whatever they are, are without any consequence. Much of the evidence about raw and pasteurized milk has already been reviewed above. The equally negative findings of Frank, Clark, Haskell, Miller, Moss & Thomas (1932) in the USA may now be added. Though direct comparison in human experiments of other forms of heat-treated or processed milk with raw milk are fewer, they are consistent in showing no ill effects of these procedures. For example, Graham & Morris (1937) found no difference in retention by five children of calcium, phosphorus and nitrogen from raw milk or from the same milk boiled. This confirmed their earlier experience with infants (Morris & Graham, 1933). Steggerda & Mitchell (1941) showed that the commercial drying of milk did not decrease the availability of its calcium for the adult. Evaporated milk is generally accepted as very satisfactory in infant-feeding, while in metabolic experiments with children Souders, Hunscher, Hummel & Macy (1939) actually obtained better retention of nitrogen and calcium from evaporated than from liquid milk.

## 10. Milk and National Nutrition

In the years immediately preceding the last war, there was increasing realization by governments and responsible bodies throughout the world that the diet of countless millions was inadequate in kind and often in quantity. In this field the Health Organisation of the League of Nations, by virile and inspired leadership, achieved successes denied in other spheres to the main body of that Society. Publications of the League prepared by leading experts dealt with the improvement of mass nutrition and especially with the raising of the dietary level of the physiologically-vulnerable classes: children, adolescents and pregnant and lactating women. The value of milk in this connexion has been exhaustively considered by the League (League of Nations, 1936a, 1936b, 1936c, 1936d, 1937, 1938; League of Nations Health Organisation, 1936, 1938; Bendixen, Blink, Drummond, Leroy & Wilson, 1937; McDougall, 1939a, 1939b) and dietary patterns have been suggested for children which included 1,000 g. ( $1\frac{3}{4}$  pints) of milk daily. In more recent years a liberal allowance has been endorsed by the United States National Research Council (1945) which recommends more than one (American) pint of milk, while

in Britain the essential need of children for milk was recognized during the war by the priority allowance under the *National Milk Scheme* of 1 pint of milk daily to all children under five and of  $\frac{1}{2}$  pint daily to children and adolescents between five and eighteen; these have also the benefit of the *Milk in Schools Scheme*. The efficacy of this measure may perhaps best be gauged by the statement of the Chief Medical Officer of the Ministry of Health in his review<sup>a</sup> on the state of public health during six years of war (Ministry of Health, 1946) that "The national provision of milk and vitamin supplements to the priority groups has probably done more than any other single factor to promote the health of expectant mothers and young children during the war . . ."

### 11. Milk in the Adult Diet

That milk is a valuable addition to the diet of the adult is hardly open to question, but it would be difficult to quote definite scientific proof of its value for the adult male or the quiescent female, though much indirect evidence, like that of the classic study of Orr & Gilks (1931) of the health of two african tribes, is available.

It is, however, in the nutrition of the pregnant, and especially the lactating, woman that milk is of paramount importance. The development of the child in the womb and, to an even greater extent, the secretion of breast-milk, place on the expectant or lactating mother demands for calcium and other minerals, for protein and vitamins, which

milk is best suited to satisfy. Her exceptional needs are recognized by the allowance of  $1\frac{3}{4}$  pints of milk daily in the League of Nations' (1936b) dietary scheme. Milk-rationing in Britain allows the expectant mother 1 pint of milk daily in addition to her ordinary adult allowance, and a similar quantity to mothers of babies under 1 year, which means that a mother who is breast-feeding may obtain 2 pints a day for herself.

There is ample evidence from animal experiments, and from observation on man, of the progressive demineralization of the skeleton in old age (McCay, Crowell & Maynard, 1935; Meulengracht, 1938; Todd, 1942; Stare, 1943). The experiments of Henry & Kon (1947a) have shown that, with the rat at any rate, the process can be stopped by raising the level, and thus increasing the potential, of the bone-minerals in the diet. It is established that a good supply of calcium is advantageous for the growing animal or child. It is less certain whether maintenance of calcium equilibrium in advanced age is equally desirable. In senility, calcium tends to be deposited in tissues other than the bone, and a more generous intake might possibly contribute directly to this aberrant calcification. It may be, however, that this is a direct result of the bone-atrophy, as in the mobilization of bone-salts in intoxication with vitamin D. If that were true, the damming of bone-katabolism by increased supply of calcium and phosphorus in the diet might well prove beneficial, and milk would be an ideal source of these elements in old age. To put it cynically, the second childhood deserves perhaps the same sort of priority for milk as the first.

<sup>a</sup> [An account of this report by the Chief Medical Officer will be found in *BMB* 1030.—Ed.]

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## NUTRITIONAL COMPARISON OF HUMAN AND COW'S MILK FOR INFANT-FEEDING

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An Advisory Committee on Mothers and Young Children recently presented a report to the Minister of Health on the breast-feeding of infants (Ministry of Health, 1944). Part II of this report is concerned with "the claims upon which arguments in favour of breast feeding have, in the past, been founded". The general arguments supporting the slogan "Breast feeding is best feeding" are: it is cleaner; it is easier; it is cheaper; it is Nature's way; breast milk is the perfect infant-food. There are psychological arguments adduced about which there is some uncertainty.

The medical arguments used in support of breast-feeding are listed under ten headings. Two are dismissed as unsupported by experts—namely, that breast-feeding produces better-shaped jaws, and that breast-feeding helps to prevent subinvolution of the uterus. Three arguments concerned with dietary deficiency-diseases in the infant are accepted by the Committee; they agree that, provided the mother's diet is adequate, the breast-fed baby is less likely to suffer from scurvy, rickets, or iron-deficiency anaemia, than the infant fed on cow's milk alone. The five remaining arguments are largely concerned with the completely-accepted fact that breast-feeding carries far less risk of infection as compared with the use of bottles, whatever the nature of their contents.

Hence the arguments in favour of breast-feeding are elaborated to cover the fact that premature babies are more

likely to survive if breast-fed, and the risk of post-operative death in, for example, pyloric stenosis, is less in the breast-fed. The whole group of infant infections—gastro-intestinal in particular—is less likely to occur in the first year of life in the breast-fed. Less tangible arguments, but probably valid in the light of experience, are that breast-fed babies are less likely to suffer from disturbances of digestion and that their general nutritional condition is more satisfactory. This last argument requires careful consideration, however. In all comparisons of breast- and bottle-feeding it is a question of "survival of the fittest", and it is seldom that the results reported have been subjected to rigid statistical analysis. For further consideration of these medical arguments in a fair and non-technical manner, the Report should be consulted. The Committee evidently felt that a good deal more research was needed before they could be certain of their ground; nevertheless, they open their recommendations with the statement that their report "will have made it abundantly clear that we share the anxiety to secure more breast feeding of infants".

### 1. Criteria of Optimal Nutrition

There is much new knowledge of the nutrient content of human and cow's milks which is not presented in the *Report on the Breast Feeding of Infants*. Before summarizing this information, attention must be drawn to some difficulties in its interpretation. The over-riding consideration in judging the value of a dietary must be its value to the consumer in terms of health and well-being—and this consideration holds of course for infant-feeding. It is not sufficient to supply nutrients in food merely to avoid clinically-recognizable signs of malnutrition. There is undoubtedly a degree of insufficiency of supply of nutrients which may lead to a slow impairment of health which is detectable only by special investigations.

The interpretation of measurements of growth, i.e., of increase in dimensions, is also open to question; it is not necessarily correct to assume that maximal rates of growth are optimal. The signs of optimal progress in development towards maturity may again be difficult to establish, both backwardness and precociousness being sub-optimal. Complete criteria of the value of a dietary to the infant should also take into account the possible effects of mal- or under-nutrition on health and well-being in adult life, i.e. on the quantity and quality of life. The position is therefore that criteria for optimal growth, development and performance at maturity are not available, and a firm assessment of the comparative nutritional merits of human and cow's milk for the infant must be deferred until they are established.

### 2. Calories: Carbohydrate and Fat

There is very little difference between the average energy-value of mature human milk and cow's milk (about 70 Cal./100 ml.). The mammary gland is very efficient in converting and secreting materials from the blood into milk. For a cow, 200 Cal. of "digestible energy" is required for each 100 Cal. in the milk (Overman & Gaines, 1933); there is reason to believe that the human mammary gland is even more efficient than that of the cow (Garry & Wood, 1946). At present-day prices, a human dietary in Britain costs about 1d. [£0.004] per 100 Cal., so that, assuming no energy to be required for mammary-gland activity, human

milk would cost 4d. per pint<sup>1</sup> to produce, whilst cow's milk is sold at 4½d. per pint to the ordinary consumer and at 2d. per pint (or it may be free) to mothers under the National Milk Scheme. There are however complex subsidies on foods, including cow's milk, which obscure the real costs. On the simplest basis, i.e. the cost of fodder for the dairy cow as compared with human foodstuffs, the cost of cow's milk is much less than that of human milk, even if the formation of milk in the cow is a relatively inefficient process. On the other hand, the preparation of infant-foods by technological processes is costly. Moreover, there are many instances in which no milk in any form, other than human milk, is available, and the question of the cheapest form does not arise.

More than 90 % of the Calories expended by an infant on a diet wholly of milk are derived from fat and lactose. Lactose is the sole carbohydrate of milk; there is more of it in human milk (about 7 %) than in cow's milk (4.5 %–5 %). Its presence in the gut is known to favour the predominance of *L. acidophilus* in the gut, but it is of some interest that *L. bifidus* I is the prevailing organism in the gut-flora of the breast-fed baby. The presence of lactose in increased amounts in human milk may, by its effect on intestinal microflora, affect the amount of synthesis of various nutrients. It also promotes the absorption of calcium and phosphorus, presumably because of its influence on the hydrogen-ion concentration of the gut-contents.

There is about 3.5 % of fat in both human and cow's milk; but it has been found recently (Hilditch & Meara, 1944) that the composition of human milk-fat differs from that of butter-fat; in particular, the fatty acid of the former contains about 7 % linoleic acid, whereas there is little or none in cow's milk. Linoleic, linolenic, and arachidonic acids, have been shown to be indispensable for the nutrition of rats.

There is an interesting inter-relationship between fats and lactose or galactose, for the utilization of the sugars appears to be dependent on the presence in the diet of certain fatty acids. Butter-fat has in fact been shown (Boutwell, Geyer, Elvehjem & Hart, 1943) to be superior to certain vegetable oils *only* if the carbohydrate in the diet is lactose. In considering these observations, the need for the rapid synthesis of glyco- and galacto-lipids in the human infant during the first six weeks of life should be borne in mind.

### 3. Protein

Infants fed on cow's milk from birth have a body-nitrogen content which increases up to an age of about six months at about the same rate as it does in the foetus; on human milk, however, the percentage of nitrogen in the body remains about the same as that at birth, and may be even lower at six months of age (Stearns, 1939). The *proportion* of the nitrogen retained from both human and cow's milk is about the same; but the *amounts* retained on human milk are smaller (about a half, i.e. in the ratio of the amount of protein in the two milks). Infants on whole cow's milk have therefore a relatively larger store of tissue-protein than breast-fed babies, some of it occurring as muscle (Catherwood & Stearns, 1937).

Increase of protein in the infant's diet is of doubtful value if its effects can be interpreted in the light of results

of increase in dietary protein for growing rats. Slonaker (1931, 1935) compared the effects of diets containing about 10, 14, 18, 22 and 26 % protein (in air-dry food). Gains in weight increased with the amount of protein in the food but, in general, performance as judged by spontaneous activity, running-distance, fertility, length of reproductive span, average number and size of litters, viability of young and length of life-span, was best for the animals on 14 % protein diet, followed by those on 10 %, and then progressively poorer as the percentage of protein increased in the diet.

By feeding a suitably-diluted cow's milk to an infant, its nitrogen-retention can be reduced so much that it equals that of a breast-fed infant. In spite of the equality of nitrogen-retention there is reduced tissue-turgor and impaired motor development in the infant on the diluted cow's milk as compared with the infant receiving more cow's milk (Jeans, 1942), the infant on human milk showing no disadvantage in its muscular development. Some factor or factors in the nature of the proteins of cow's and human milk may be concerned, and differences in the amino-acid composition of the proteins of the two milks might afford an explanation, though recent data (Williamson, 1944) do not reveal remarkable differences. In order to be able to make a comparison of the amino-acid composition at equal total-protein contents, whole cow's milk must be diluted with about an equal volume of water to contain 1.4 % casein and 0.25 % lactalbumin, whilst human milk contains 0.5 % casein and 1.0 % lactalbumin. There is more than 30 % more tryptophan in human milk than in this diluted cow's milk, but about 20 % less threonine, valine and histidine. In human milk there is three times as much cystine, but less methionine, than in the diluted cow's milk; there is, however, not much difference between the two milks in the total sulphur-containing amino-acids (i.e. cystine+methionine). The significance of these data cannot be appreciated until we know more about the amino-acid requirements of the infant.

The foregoing evidence would provide grounds for feeding protein at a lower level than that required for maximum growth and nitrogen-retention; on the other hand, Clements (1946a) has agreed that the protein-reserves of the infant should be maintained at the highest possible levels in order to support maximum synthesis of antibodies.

Half a century ago, Bunge drew attention to an interesting relationship between the protein-content of the milks of

TABLE I. PERCENTAGE PROTEIN IN THE WHOLE MILKS OF DIFFERENT ANIMAL SPECIES AND THE TIME IN DAYS TAKEN FOR DOUBLING THE BIRTH-WEIGHT OF OFFSPRING

Species	Protein	Days
Man ... ..	1.6	180
Cow ... ..	3.8	70(47)
Horse ... ..	2.7	60
Sheep ... ..	5.4	35(15)
Goat ... ..	3.7	22
Pig ... ..	6	14
Dog ... ..	7.5	9
Guinea-pig ... ..	5	7
Rabbit ... ..	14	6
Rat ... ..	12	6
Pigeon-crop "milk"	13	2

<sup>1</sup> (1 pint = 0.568 l.—ED.)

various animal species and the rate of growth of offspring as measured by the time taken to double the birth-weight. Brody (1945) has recently modified and extended the data; some of his figures are reproduced in Table I. Brody remarks that the "situation is too complex for a simple generalization, although, no doubt, speed of growth, composition and physiologic age . . . of the young at birth are important factors in determining the evolutionary trend of milk composition." It might be noted here that the amounts in milk of nutrients other than protein follow somewhat similar trends.

#### 4. Minerals: Calcium, Phosphorus, Iron and Copper

**Calcium.**—Cow's milk contains on the average 120 mg. calcium per 100 ml. milk—about four times as much as human milk; the concentration in both varies considerably with the nature of the diet. As with nitrogen-concentration in the body of the infant after birth, that of calcium differs with feeding with the two milks. For both, however, there is a decrease for some weeks after birth; the infant on human milk may not regain its calcium-concentration at birth until it is one year old. There is more efficient absorption of calcium from human milk, but the total amount supplied in cow's milk is so much greater, that the infant retains as much if not more calcium from the latter as from human milk. The linear growth of infants on a standardized cow's milk preparation is related to the amount of calcium retained (Jeans, 1942). The breast-fed baby, however, has an excellent linear growth at a much lower calcium-retention, and grows at a definitely greater rate than the artificially-fed baby with the same calcium-retention. We agree with the following recent comment (Macy, Williams, Pratt & Hamil, 1945) on these observations:—

"No one knows whether the biggest baby, or the one who stores the most calcium, has a greater advantage throughout life than the infant fed breast milk, who may grow more slowly but with greater nutritional stability and may extend that steady growth farther into childhood. Indeed, studies of animals indicate that years may be added to the life span and life to the years by giving diets complete in all known dietary essentials which produce slow but steady growth."

**Phosphorus.**—The amount of phosphorus in human milk (15 mg./100 ml.) is only about one-sixth of that in cow's milk, but is sufficient in proportion to the amount of calcium and protein. About two-thirds of the phosphorus of cow's milk is excreted by the infant in urine.

**Iron.**—Human milk contains rather less, on the average, than 1 mg. of iron per 100 ml., about three times as much as cow's milk. The infant is, however, born with considerable stores of iron, and haemoglobin-levels are maintained for several months; on cow's milk, the baby's retention of iron at 3 months of age is almost negligible.

**Copper.**—There is about 0.25 mg. of copper per litre in human milk, and much less in cow's milk, so that the latter in respect of both the minerals concerned in haematopoiesis is inferior to breast-milk.

#### 5. Fat-soluble Vitamins A, D and K

**Vitamin A.**—The vitamin-A potencies of cow's and human milk do not on the whole differ appreciably, though the proportion of preformed vitamin A to carotene is less (1 : 1) in cow's than in human (3 : 1) milk (Lawrence, Herrington & Maynard, 1945). The human-milk content of this

vitamin differs according to the dietary and may be so small as to lead to xerophthalmia in the infant. The amount in cow's milk is known to vary with the type of feeding, and values of 140 and 70 international units per 100 g. may be taken (Medical Research Council, 1945) as representative of summer- and winter-milk respectively. There is no reason to believe that the amounts available in the milk of a well-nourished woman are not sufficient to meet the normal infant's requirements.

**Vitamin D.**—There has been much more concern about vitamin D (Mackay, 1944). It is true that infants with foetal rickets may develop in women suffering from osteomalacia due to calcium-deficiency in the diet, and that there are statements that rickets may develop in both breast- and artificially-fed babies, possibly more commonly in the latter. The vitamin-D content varies considerably in human milk from 0.4-10 international units, and in cow's milk from 0.5-4.0. But these quantities are probably quite unrelated to the real needs of the infant, which might be expected under natural conditions to synthesize part, at any rate, of its vitamin D in (or on) the skin during exposure to sunshine. At the present time, we must agree in the light of our remarks above that "without more knowledge of the proper balance of the nutrients we should not do everything in our power to increase the rate of growth of babies and then complain that this rapid rate of growth brings them to the verge of rickets" (Garry & Wood, 1946).

**Vitamin K.**—One view about vitamin K is that sufficient is present at birth to last the infant until it synthesizes sufficient microbially in its own intestine to supply its further needs; the other, that the supply to the foetus is determined by the amount derived by its mother from her diet (Clements, 1946b). In the latter event, if the mother eats reasonable amounts of green vegetables, then the infant will be born with adequate supplies, and its further immediate requirements of about 1 microgram daily may be supplied from 30-60 ml. of milk.

#### 6. B Vitamins

The amounts of certain B vitamins in mature human and cow's milk have been summarized recently (Lawrence

TABLE II. B-VITAMIN CONTENT (MICROGRAMS) OF FRESH MATURE HUMAN AND COW'S MILK

	Mature human milk	Cow's milk
Vitamin B <sub>1</sub> ...	14	22
Riboflavin ..	37	200
Nicotinic acid	183	25
Pantothenic acid	246	250
Pyridoxin .	4	67
Biotin .	0.8	3
Inositol .	32,000	8,000
Folic acid ...	45	5

*et al.* 1945) and are reproduced in table II. There is again considerable variation in the content of human milk of some of these nutrients, depending on the diet of the mother. It has been known for many years (Andrews, 1912), for example, that the milk of mothers whose infants had died from beriberi would produce beriberi in puppies suckled by these women. There are also variations in the B-vitamin

content of different cows' milks ; on the whole, the variations are not so pronounced as in human milk, probably due to the contribution of B-vitamins from microbial activity in the cow's alimentary canal. Some of the differences in individual B-vitamin content between cow's and human milk are considerable.

The amounts of each available to the infant should obviously be considered in relation to its requirements ; in doing so, some authorities, having accepted recommended allowances, have argued that the amounts of some B vitamins obtained from the mother's milk in breast-feeding are inadequate. The bases of requirements for B vitamins for the infant are generally not sufficiently well-founded to justify dogmatism on this point. It is, however, important to recognize the need for a balanced supply of the B vitamins. Richards (1945), for example, has shown that the administration to animals of relatively large amounts of a single member of the B-vitamin complex may induce signs of insufficiency of other members of the complex—at any rate in the offspring of the mothers to which the unbalanced mixture has been fed.

### 7. Vitamin C (ascorbic acid)

Cow's milk, which on the average at milking contains 2 mg./100 ml. of ascorbic acid, is a much poorer source of vitamin C than mature human milk, which contains about 5 mg./100 ml. The amounts in human milk are higher in the earliest days of lactation and may vary seasonally, or otherwise, in relation to the amount of vitamin C in the mother's diet. The infant normally is born with substantial stores of ascorbic acid. It is generally conceded that there is ample ascorbic acid in human milk from properly-nourished mothers.

### 8. Amount and Composition of Human Milk

Given an adequate diet, the composition of human milk does not after the early days vary much throughout lactation. If there is insufficiency of proteins, fats or carbohydrates in the mother's diet, then the usual response is a reduction in the amount of milk secreted ; shortage of vitamins in the diet leads to a reduced concentration in the milk, whilst shortage of minerals may lead to a drain on the mother's reserves. From this knowledge, the correct inference is that to maintain the quantity and quality of human milk the mother must be adequately fed—and watered ! This provision, in so far as lactation is concerned, should apply to the period of pregnancy for ample mammary-gland formation, and generally in preparation for lactation, as well as to provide flesh which may, in the interests of the infant, be milked-off during lactation.

### 9. Balance of Nutrients in Human Milk

Evidence is accumulating of the great importance of a proper balance of nutrients in the diet for optimal digestion, absorption and utilization ; for example, of the importance of amino-acids for absorption of calcium and possibly also of phosphorus, of phosphate for absorption of carbohydrates and possibly of fats, of vitamin D for absorption of calcium and phosphorus, and of the inter-relationship of the absorption of iron and

calcium. The effect of lactose on the nutritive value of fats, and possibly in other connexions has been mentioned above. There is a close inter-relationship in metabolism, particularly in the liver, between B vitamins, some amino-acids and other metabolites. There is no doubt, too, of the superior nutritive value of dietary proteins having an amino-acid composition matched to the body's needs. All this evidence points to the need for as great a concern about the balance of nutrients in the infant's food as of the actual amount of any one nutrient.

In the past, preoccupation with increasing rates of one of the elements of growth, for example, of weight, by dietary means, may have led to competition in the body for nutrients, with detriment to the balanced achievement of the infant's genetic potentialities. It is of interest in this connexion to draw attention to the prevailing concept that the normal infant is born with stores of iron sufficient for it to maintain haemoglobin-formation for six months, whereas rate of increase at birth of calcium- and nitrogen-concentration is rather regarded as a pace which ought to be maintained after birth.

### 10. Supplementary and Mixed Feeding

It would seem that there are no good reasons for giving single-nutrient supplements to breast-fed infants, with the possible exception of vitamin D where appropriate radiation of the infant is not feasible. The procedure of choice is to supply an adequate diet to the mother, and supplementary feeding of the infant should ideally be such as to maintain a balance of nutrients similar to that of milk from the breast of a healthy, well-nourished woman. Such supplementary feeding would in a sense be mixed feeding.

Mixed feeding has been regarded in Britain as a preparation for weaning of the infant from the breast. The tendency in recent years has been to reduce the age at which mixed feeding is begun ; at the same time, there is an associated tendency to reduce the period of breast-feeding. It is a common feature in many parts of the world (Platt & Gin, 1938) to begin some form of mixed feeding at a very early age, and to continue breast-feeding beyond one year, sometimes as long as five years. The main supplementary foodstuff is a cereal gruel or "pap", though small amounts of a variety of foodstuffs are also given to the infant. There appear to be no good reasons why these practices should be impugned ; on the contrary, the early employment of cereals in mixed feeding may be valuable "training" for an infant whose diet in later life will be largely based on cereal-grain products and, in the absence of supplies of other mammalian milks, it is clearly desirable to continue breast-feeding provided that the mother is adequately fed.

### 11. Conclusions

There are good reasons for favouring human milk as against cow's milk as a basis for infant-feeding. The importance of the balance of all the nutrients, as well as the content of individual nutrients, in the infant's diet should be appreciated. It is not possible precisely to relate the supply of nutrients to the infant's requirements, since the latter are not well-established. Single elements of growth and development cannot be accepted as criteria of adequacy

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## INCIDENCE, CAUSES, AND PREVENTION OF FAILURE OF BREAST-FEEDING

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- 1 Failure in the first three months
  - 2 Production and removal of milk
  - 3 How does the baby obtain the milk?
  - 4 Hindrances to effective removal
  - 5 Prevention of failure
- References

No reliable statistics exist which allow us to compare the proportion of women who feed their babies at the breast today, and the length of time they continue to do so, with, say, fifty years ago. It is estimated that at the present time not more than half the babies born in Britain are breast-fed for longer than 3 months, and that by 6 months the proportion has fallen to 40%. Whenever these low figures are mentioned, the question arises of the extent to which a true inability and a mere unwillingness are responsible. Many hold strongly that unwillingness is largely to blame, but the evidence for this view is not very convincing and is seldom reduced to statistical terms.

Unwillingness may well find freer expression than formerly, now that the risks of artificial feeding have been so greatly reduced. For over 30 years there has been in Britain no serious epidemic of summer diarrhoea such as used to claim its victims by tens of thousands in every

hot season. Its dread reputation has faded from women's minds, and with it has gone the strong incentive to keep their infants breast-fed at all costs as their only real safeguard. The great fall in the birthrate and the reduction of, at least, abject poverty have had a similar influence, since the cost of artificial feeding is proportionately a much less severe drain on the family income than it was a generation ago. I do not myself meet frank unwillingness at all often, and put its frequency lower than do some observers. On the other hand I have no doubt that the fear that a child is undernourished at the breast is a very common reason for substituting bottle-feeding. The fear may be groundless, though by no means always so, and the motive, which in reality was anxiety, is easily mistaken for unwillingness.

### 1. Failure in the First Three Months

So much of the security of breast-feeding depends on events during the early days of milk-secretion that the factors held to be responsible for failure with which this paper will deal are centred on that period. The views put forward have been mainly derived from clinical studies made at a maternity hospital and at infant-welfare centres in south and east London. No attempt is made to discuss failures in the later months, partly for reasons of space, but mainly because the earlier the deprivation of human milk the greater the risk to infant life. We have seen that five out of six failures have occurred by the end of the third month, and in my experience a high proportion of these have already taken place by the sixth week or soon after, and many are directly traceable to influences in the first fortnight.

Now, if anything unfavourable to success should gain entry, however unwittingly, into the management of breast-feeding during the lying-in period, and especially should it become incorporated in the teaching of training-schools for nurses and midwives, its effects may become disastrously widespread. The danger is increased by the large number of women now confined in hospitals. A generation ago, rather less than one-twelfth of all

## NUTRITIONAL COMPARISON OF COW'S AND HUMAN MILK

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of an infant dietary. With the possible exception of vitamin D, there is not a good case for supplementing the infant dietary with single nutrients; there may be a case for early mixed feeding

and prolonged breast-feeding. It is of paramount importance, in the interests of both mother and infant, that the mother be specially fed during and also for some months before lactation.

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deliveries in London took place in institutions, whereas at the outbreak of war the proportion had risen to over two-thirds. That is to say, it was eight times as high, and today it is higher still. The tendency of nursing in hospitals is always, and understandably, towards working to a timetable, and routine, like arteries, is liable to become rigid with age. If the routine can be planned to meet the needs of both aspects of breast-feeding—the physiological requirements of milk-production on the one hand, and on the other the demands of the infant for food, sleep, warmth and so on—then it can be all to the good. But it can be quite the opposite if these necessities must fit as best they can into a design arranged primarily to suit the hours of nurses and domestic staffs.

Another difficulty is the short time allotted to the puerperium and the consequent lack of observation beyond that stage which should allow the effect of methods applied in the early days after childbirth to be tested by results. For this reason I believe that not very much value can be attached to the high percentage of breast-feeding at 12 or 14 days which maternity hospitals publish. Care of the newborn has made great advance within recent years, and there is today not only more precise knowledge of its nutritional needs than ever before, but a far better appreciation also of the value of careful nursing, of provision against infection, and of many other details. The premature baby's vastly-improved chance of survival is a good illustration of improved care. It is therefore not a little disappointing that nothing comparable can be recorded by way of control over the unreliability of women's lactation; indeed, it may be doubted if anything worthy of the name of advance has occurred within the last generation.

## 2. Production and Removal of Milk

Full understanding of milk-production and its steady maintenance must await further light from the physiologists, but the principle of repeated and efficient emptying of the gland, so well recognized as a necessity in dairy farming, holds good for the human also. The more the child takes, the more will be produced. Sections of the gland after weaning show that the process of involution begins with distension of the alveoli by residual milk and is followed by disintegration of the secreting cells. So that we may say that if production is to be maintained, tension within the breast must be kept below the point at which the rate of secretion is reduced, and will ultimately cease, by compression of the secretory cells. Before the use of perambulators became general, and when women carried their babies, the child of the right-handed mother spent a large part of its life supported on her left arm. From this position it fed in comfort, while at the other side it was awkwardly poised. In consequence it was quite common to find feeding confined to the left breast in each lactation, and the right devoid of milk and only perhaps a third of the size of the productive side. This was of course reversed in the left-handed, but since carrying has been replaced by wheeling, one-sided feeding is seen only when one breast is drained and the other refused because of a malformed nipple.

Another example of incomplete removal arises when more milk is produced than the child can possibly drink. There is a variable factor here, not only in the size, the

vigour and perhaps the maturity of the child; but also, as Engel (1941) has very convincingly shown, in the amount of secretory tissue in different women. Thus, of two young mothers in my hospital at the same time, one never yielded more than 4 ounces<sup>1</sup> of milk in any day throughout her stay, while the other produced a measured amount of 55 ounces 5 days after her baby was born, and her yield remained at about this level. Now, every midwife would realize that the first woman's baby needed additional milk, and would probably have the knowledge to calculate how much. But I am doubtful whether many would realize the need to remove the excess from the breasts of the second woman, or indeed how to accomplish its removal. It is often said that an excess is of little account, and that the yield soon lessens until a balance is struck between supply and demand. This is contrary to the experience of many women, who tell me that they had too much milk while they were in bed, but that it left them shortly after they got up, and it is fully confirmed by examination of the breasts. In the example mentioned, the most the baby could drink in a day was 25 ounces, or less than half of what was secreted; while its calorie-needs were fully met by 18 ounces.

The danger of high milk-tension is specially great in the early days, and may depend less on the volume than on the rate at which the milk "comes in", as when, within the space of a few hours, the breasts become full and hard, and the skin covering them tightly stretched and glistening. With a more gradual beginning, milk soon flows from the nipples, but, when the start is of this violent kind, not only is there no outflow but it may be impossible to induce any. It is usually quite easy to detect that the skin is oedematous, particularly in the areola, and it seems that what can be found on the surface involves the ducts as well and produces obstruction. The child can of course do nothing to reduce tension to a safe level, and, indeed, if put to the breasts, merely damages the nipples, which often share in the oedema. Suckling becomes a torture, and not uncommonly mastitis supervenes. In any case, unless the engorgement is quickly overcome regression sets in and within about a fortnight production has ceased and the breasts have begun to return to the resting state. A very large proportion of women who have early resort to bottle-feeding give this account of the start of lactation. Clearly, therefore, the early establishment of a free outflow and effective drainage is of great importance and demands that we should consider the mechanism of the milk's removal.

## 3. How does the Baby Obtain the Milk?

To watch a baby at the breast it seems obvious enough how it gets its food. We can see it suck, notice the regular action of its jaw, and both see and hear it swallow. Gunther (1945) has shown that it can exert a negative pressure of 200 mm. of mercury. And yet I believe that the impression that it is sucking the milk out is deceptive, and that the main role of suction is to draw the nipple far back into the mouth and keep it there; meanwhile the combined action of jaw, tongue and cheeks squeezes milk from the reservoirs which lie beyond the base of the nipple beneath the areola.

<sup>1</sup> [1 fluid ounce = 28.4 ml.—Ed.]

But the baby's share in the act of suckling cannot of itself empty the breast. The lacteal sinuses must be replenished from within the gland, and this demands of it some power of expulsion. On this point, comparative studies have thrown much light. In the dairyman's phrase, the animal "lets the milk down", and he knows that, if the fullest amount is to be milked out, he must use his hands quickly and continuously while the flow is free. The explanation of this came when Tgetgel (1926) showed that as the teats are handled there is a sudden rise of pressure within the udder. Taken in conjunction with the difference, which is revealed in fractional milking, in the fat-content of the first and last milk to be withdrawn, the conclusion seems clear that the milk within the duct-system is forced down into the large reservoirs or "cisterns", the lowest of which are situated in the teats. The rise of pressure lasts a matter of minutes only, and more recent work by Ely & Petersen (1941) makes it seem likely that it is produced by posterior-pituitary hormones acting on plain muscle around the alveoli and in the walls of the duct-system. The amount of milk usually withdrawn can be increased by about one-fifth by an injection of pitocin or pitressin. Between milking, secretion is continuous, and Hammond (1936) has suggested the most heavily fat-laden fraction is delayed in the alveoli and finest tubules, while the remainder passes down and distends the larger ducts and cisterns. He contends that some expulsive mechanism capable of driving out the contents of the finest tubules is essential. Here, then, is evidence of a very delicate reflex evoked by manipulation of the teats, but it also requires that there should be a certain accumulation of milk, that is to say, a certain level of tension within the udder. Pain and fright can inhibit the reflex, a fact so well known in dairying that a variety of means are used to quieten animals at the milking-time.

It is strange that, whereas women are well aware of this expelling mechanism, it has received little attention as a factor of value in the management of breast-feeding. It is true that, unless questioned, many do not mention it to us, though they discuss it freely among themselves. But probably the oversight arises more freely from the fact—and this applies particularly to the first lactation—that the tingling or "drawing" which accompanies the reflex, and which they call the "draught", quite often is not experienced clearly during the puerperal period. It attracts their attention only later, when they realize that it coincides with the outrush of milk which follows within a second or two after the baby draws the nipple into its mouth. The explanation of this delay, I think, must be that it takes time for the lower part of the duct-system to become stretched and able to expand to accommodate the milk secreted between feeds. Until that has taken place milk leaks from the breasts at short intervals, and in the next phase leakage is confined to one breast as the child feeds at the other. Later yet, a third stage can be defined, when the "draught" is felt but there is no overflow, the large ducts and sinuses being now able to contain what is forced into them. The rapidity with which the child then obtains the milk, and the fact that by about the 4th week women often say that the "draught" has become actually painful, suggest that the reflex becomes more powerful as feeding proceeds. Women who have previously breast-fed a baby do not have to graduate by these stages, for the stretching has already been done; they

start at the third stage, and so are often aware of the "draught" by the 3rd or 4th day after delivery, feeling it almost from the start of active secretion.

Another point deserves notice. The ability of the ducts to serve the purpose of a reservoir will be aided if the skin covering the breasts is elastic and can yield as they fill. Here, as in almost every anatomical feature of this gland, wide differences exist. In some women the mammary skin is as thin as paper and there is the least amount of subcutaneous fat, in others it is thick and unyielding and a common cause of excessive tension as the milk first comes in.

The analogy of the "draught" with the reflex rise of pressure which Tgetgel demonstrated in animals is shown by the fact that it coincides with a sudden outflow, that it is of short duration lasting for some 30-45 seconds, and that analysis shows the same difference in the fat-content of the first and last milk to be withdrawn. Moreover, it is easy to show that the fat has already become diffused through the milk within the second breast while the child is feeding at the first, Waller (1943), corresponding with the change found by Crowther (1916) when the four quarters of an animal's udder are milked in turn. The breast becomes firmly conditioned to a regular feeding-interval; that is, to a certain level of milk-tension, so that many women find that the "draught" is punctually evoked when the hour arrives and without the direct stimulus of suckling. Some are so well alive to the completeness of emptying which the "draught" affords that they waken the child when, as they say, the "draught" comes in. Indeed, they rely upon the strength and regularity of the "draught" as a sign of the security of their yield, and will often describe its weakening and delay as grounds for fearing that the yield is declining. This is reflected in the child's behaviour: for the child also very quickly becomes conditioned to the easy access to milk which the "draught" affords, and feeds for just so long as the flow lasts. Failure in its punctuality will provoke a storm of protest, and a weakening of its strength leads to refusal to go to the breast.

#### 4. Hindrances to Effective Removal

In referring to the baby's contribution towards emptying it was mentioned that it draws the nipple far back into its mouth. This must be qualified since, in many women the nipples, one or both, have failed to reach the complete stage of development which makes this possible. The inverted and the much-retracted forms are well recognized as a serious handicap, and may make feeding an impossibility; but there are many which appear to be well-enough formed, but which a simple test shows are not so and which will give difficulty. If the areola is pinched between finger and thumb just behind the base of the nipple, the action is a fair imitation of the baby's grasp. The nipple which is quite loose in its attachment to deep tissues projects in response to this test, but when any such attachment persists it retracts towards the breast. Applied to 200 primigravidae, the range of protraction of the nipple when tested by this method was found to be good in 49, moderate in 95, and poor in 56, Waller (1946). Even if we disregard the middle group, there were over one-quarter whose babies were bound to be confronted with great difficulty.

Another point revealed by the test is the position, and so the accessibility, of the lacteal sinuses, and I believe that,

with practice, one gains an impression of their size and number. If the nipple is normally developed, they lie close to its base, and colostrum is readily expressed from them. With the retracting type, they are situated farther back, and if the malformation is marked they appear to be lacking, so that pressure has to be applied to the substance of the breast itself before any colostrum can be expressed. Much variety also is revealed in the number of ducts opening on the surface. Instead of the large number of from 12 to 20 which is described as the normal, it is common to find a main central opening with only a few others, and not seldom the central one alone. When single, it may drain into the bottom of a circular depression or lie in a transverse furrow, and this last type is most often found in the inverted or much-anchored nipple, suggesting that it is part of the developmental error.

Here, then, is a hindrance to the ease with which the firstborn can feed that will militate against effective drainage and, if the figures I have given are at all representative, and not peculiar to women seen in east London, then we must expect to meet it in a high proportion in the first lactation. But to this must be added the handicap of anything which lowers the efficacy of the baby's contribution. Now the effects of labour may be so severe that for several days the baby may make only the most perfunctory efforts to feed, and improvement may be very gradual and not complete until 3-4 weeks have passed. An infant with any respiratory difficulty will sometimes sustain the effort of drinking for but a few moments at a time. The sucking-reflex of the premature infant may not be fully developed, and even the mild form of jaundice may produce a drowsiness during which little vigour is put into the act of feeding. And the list of causes of defective sucking could be much extended. In view of the number and variety of factors from the side of both mother and child which can complicate the start, I have long ceased to be able to subscribe to the opinion that breast-feeding is a simple, natural function at which almost any woman can succeed given sufficient willingness and determination. I doubt if this holds good for more than one-third of them with the firstborn. Quite half will experience difficulties varying in kind and degree; while about a fifth can hope to succeed only if they can command help of the most skilled nature for several weeks, and even so half of this last group may have to admit failure.

### 5. Prevention of Failure

If the problem is approached with the nature of the difficulties kept clearly in mind, there is a good deal that can be done to overcome them. We have at my hospital found two measures of great value; one in easing the baby's task, the other directed to improve the freedom of escape of the milk. The restricted range of protrusion of the nipple can be much increased by a simple orthopaedic appliance. All women with this defect are supplied with a pair of glass shields which they wear during pregnancy under a well-fitting brassière. The shield has a central opening which is placed over the nipple; the brassière exerts enough pressure gradually and painlessly to force the nipple through the opening and loosen its attachment to the breast. The time for which the shields should be worn depends on the degree of the defect, and this should be estimated early in pregnancy. For most it is long

enough if they are used for the last 10 weeks before term; it is not wise to start later in case of a miscalculation and the possibility of premature delivery.

The second measure is to teach women the technique of removing the milk by hand. This is often done, but I would emphasize that, to be effective, it is a skilled manoeuvre which calls for exactitude and practice. As taught at our hospital it has two components; the first a downward movement in which the hands compress the whole breast from its margin to the areola. This is repeated several times. In the second the position of the lacteal sinuses is found and they are emptied by repeated compression between the forefinger and thumb. It is taught to all in their first pregnancy and to those who have had difficulty or failure in a previous lactation, and they are instructed to practise it daily for the last 6-8 weeks before term. It has become a routine since the discovery that those who were first taught, in order to have the necessary skill when lactation started, were the least liable to suffer from engorgement. The explanation is, we believe, that the ducts are distended by the exercise, which forces colostrum through them, and the primipara thus begins her first lactation with some of the advantages of one who has already breast-fed a child. To test our impression that this procedure was of value, we carried out a controlled experiment and compared 100 who were taught in their first pregnancy with 100 who were not, both groups being treated alike in all other respects. The results showed that not only had the pupils by far the easier start in breast-feeding but that, when both groups were reviewed at six months, 83 of the 100 were still wholly feeding as against 42 of the controls. More recently, we have found that of 300 primiparae who passed consecutively through the hospital, 79% were also successfully breast-feeding at six months.

These two procedures must be supplemented by a constant watch on milk-tension during the puerperal period, and a very delicate sense has been acquired by the nursing staff of what is safe and when safety threatens to be exceeded. Of late years, we have employed synthetic oestrogens to check the very sudden outburst of secretion that overtakes some women, and which previously we had great difficulty in controlling. It is a method<sup>2</sup> of great value but requires experience; we have not been able to standardize dosage, which has to be judged by each woman's reaction. It should be stopped as soon as tension begins to fall.

A very special watch is also kept for damage to the nipples. The nurses are instructed to enquire whether suckling causes pain and to encourage the mothers to admit and not to conceal it. If the least breach of the nipple's surface can be seen through a lens, feeding is withheld until it is securely healed, the milk meanwhile being expressed by hand. I am satisfied that to this we owe many years of almost complete freedom from breast-abscesses, even before we had the help of modern chemotherapy. And, though it is more difficult to prove, I believe that the course of breast-feeding is far smoother when it is free from pain, and from the apprehension of pain. From many descriptions of what women have suffered when trying to feed with broken nipples, there can be no doubt that it must interfere with the "draught" reflex.

<sup>2</sup> [The hormonal inhibition of lactation is discussed in this number by Dr. Josephine Barnes (*BMB* 1107).—Ed.]

## BREAST-MILK BANKS\*

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- 1 Sources of supply
- 2 Situation and specifications of a bank
- 3 Control of donors
- 4 Collection of milk
- 5 Conservation of milk
- 6 Organization

The first breast-milk bank was founded in Boston, Massachusetts, in 1910. This service is still in existence and is known as the Directory of Mothers' Milk. The first centre in Europe was opened at Magdeburg in 1919. There are approximately 20 centres in Europe and in the USA and Canada respectively, and several in South America. In Great Britain at the present time there is only one centre which supplies breast-milk for use outside the hospital, namely Queen Charlotte's Hospital. Had it not been for the war, at least two similar centres would have been in operation.

The trend of opinion at the present time in the United States seems to be that expenditure on breast-milk banks

\*[Note.—The reader may wish to refer also to an article on "Human milk bureaux" by Dr. Joyce Wright in the *Monthly Bulletin of the Ministry of Health and the Public Health Laboratory Service* (1947, 6, 74-77). This is the text of a report to a special committee of the Medical Research Council.—Ed.]

is unjustified, because the preparation of cow's milk formulae has now reached such a high state of perfection as to render the provision of human milk by this means unnecessary. It is further pointed out that when human milk is used for premature infants, it must be modified. Recent work in the United States seems to suggest that premature babies do equally well on cow's milk formulae. These opinions are by no means universally held, but should be borne in mind when consideration is being given to the establishment of a breast-milk bank.

### 1. Sources of Supply

The question of an adequate supply of donors is of fundamental importance, and has been a matter of concern to most breast-milk banks. Most donors appear to be obtained from the poorer sections of the community, who are paid according to the amount of breast-milk given. In consequence, when times are good, the supply of donors tends to fall. A further difficulty in America is that the incidence of breast-feeding is low in many parts of the country. It is necessary to elicit the interest of doctors, midwives and nurses, as well as of the mothers themselves, if a sufficient supply of milk is to be maintained. Too much stress should not be laid on the financial benefit to mothers. They should be made to feel they are performing a social service. In this way, it may be possible to get co-operation from mothers in higher-income groups. In some areas it is customary to make contact with the mother before the baby is born. In these cases, mothers begin to supply milk before the end of the first month. In some cases mothers are registered for this purpose as late as the sixth month of the lactation-period. The mother remains on the register as long as she is lactating and her milk is of good quality and quantity. This may be for as long as eighteen months. This does not mean that the mother nurses her baby beyond the accepted period. Other centres discontinue the taking of milk at the end of the ninth month after delivery.

## FAILURE OF BREAST-FEEDING

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Perhaps the most difficult problem of all is to gauge the appropriate interval between feeds. The baby's intake is found by test-weighing, and the number of feeds required in the day is calculated so as to bring the amount up to its caloric needs. Full drainage of the breasts is secured by the method described. The nurses instruct the mothers when milk should be expressed by hand, and give them such assistance as they need; for the most part they can do it without help. A long interval at night is a disadvantage which leads to the breasts becoming overfull and the baby crying with hunger. Were the staff available, I should favour most women giving a night-feed at this stage; few abstain from doing so when they return home, and I think that their lactation benefits. The length of time a baby spends at the breast is not regulated, but continues as long as it can be persuaded to drink. We do not see the bad results which are so often attributed

to overfeeding and, though it is something of a heresy, I am persuaded that most babies profit by getting the milk quickly. With feeding directed in this way, some two-thirds of the mothers have a definite appreciation of the "draught" reflex before they leave hospital.

Finally, and as an instance of how drainage alone can maintain milk-secretion, the staff has much success in enabling the very premature infant to be breast-fed. The mother is retained until she is skilled in removing her milk by hand, and on her return home she sends or brings it once daily to the ward. Her infant stays in the special nursery until it reaches a weight of 4-4½ pounds\*, when the mother is re-admitted. It seldom takes more than a few days for direct feeding to be established. The average length of stay of these babies in hospital is 40 days.

\* [1 pound = 0.454 kg.—Ed.]

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## 2. Situation and Specifications of a Bank

The bank may be sited in a maternity or children's hospital, or in a separate building. If it is situated in a hospital, it is not considered by some authorities desirable that it should be placed in the milk-kitchen. In other institutions, breast-milk and cow's milk formulae are dealt with in the same milk-kitchen, usually at different times and with separate staff. The amount of accommodation provided varies, depending on whether the milk is collected at the mothers' own homes or at the institution. In the former case, at least four rooms are required—a waiting-room, office, refrigerator- and sterilizing-room with equipment for washing bottles, etc., together with a staff-room and sanitary accommodation. In the case of the latter, there will be required in addition a mothers' dressing-room with cubicles and possibly a nursery for the temporary accommodation of any children the mothers may bring with them, and a milk-expression room with a separate booth for each mother.

The rooms should be light and well ventilated and the walls finished with a washable paint. The floors of rooms where the milk is handled or stored should be of impervious material and easily cleaned. All furniture in these rooms should be made of material which can be scrubbed. If the milk is to be expressed at the institution, then the mothers must be given clean overalls to put on after they have removed their outdoor clothing, and caps and masks must also be provided for their use. A detailed list of the plant and equipment is given in an article on Recommended Standards for the Operation of Mothers' Milk Bureaux in the *Journal of Pediatrics* (1943, 23, 112).

## 3. Control of Donors

In most cases the examination of the mothers is stringent. One or two centres think this is unnecessary as the milk is always sterilized. Precautions must be taken to see that the health of the donor's infant does not suffer, and the child should be weighed and examined at regular intervals. The health of the staff is also important and they should undergo a thorough medical examination. There should also be enquiry into the family history of the donor. In every instance, the home of the mother should be visited to get a picture of the economic situation and general hygienic conditions of the home. This initial visit must be followed by periodic home-visits by the nurse to see that good conditions are maintained.

In most centres the examination of the mother includes radiography of chest and heart, sputum-test, throat- and nose-cultures, vaginal smears and Wassermann test. This examination is carried out before the mother is accepted as a donor and also after any illness.

## 4. Collection of Milk

The milk may be collected at the mother's own home, at the maternity hospital, or the mother may come daily to the breast-milk bank and express it there. In some cases, the mother may be resident at a hostel attached to the bank. In their efforts to get an adequate supply of milk, some institutions use all these methods. In most cases, whether the milk is obtained at home or in the unit, strict aseptic precautions are used for the collection of the milk. Expression of the milk may be by hand or

hand-pump, water-pump or electric pump. The mother must be taught not only how to express her surplus milk, but also how to do it aseptically. The average amount expressed at any one time is 15 ounces<sup>1</sup> but it takes a donor at least a month to reach this level. The peak is reached at three months. The amount collected daily by breast-milk banks in the United States has varied from 5 to 256 ounces. In 50 % of these banks the supply was equal to the demand, but in the rest the supply fell short. If the milk is collected centrally, then it can be dealt with immediately. If, however, it is collected from the mother's own home, then containers with ice must be supplied for the mother's own use and means for their transport must be arranged. On these visits to the home, the nurse can supervise the technique of expression.

Whether the milk is expressed at home or in the hospital, the mother should wear a clean gown of washable material and a cap to cover the hair completely, and a mask should be worn. The hands and nails must be well scrubbed, and the breast and surrounding chest areas must be thoroughly washed.

## 5. Conservation of Milk

After expression, the milk is immediately chilled to a temperature<sup>2</sup> of 40° F. and pooled. Thereafter the milk is pasteurized. During cooling, after pasteurization, the bottle should be frequently inverted to prevent butter-fat from clumping. The milk is then kept in a refrigerator at 40° F. until used. Adequate pasteurization is checked by phosphatase-test and bacterial counts. If the milk is obtained in the mother's own home, tests must also be made for dilution by water or adulteration by milk other than human. The bacterial count for the pasteurized milk should not be more than 10 colonies per cm.<sup>3</sup> nor should the fat-content be less than 2.9 %.

In most instances, the available supplies are used within 24 hours. Even if not used in that time, some centres state that boiled milk keeps for a long time in an ordinary refrigerator. In most centres, however, any surplus remaining after 48 hours is preserved by one of the following methods—quick freezing, slow freezing, or fractional sterilization.

In the quick-freeze method, the milk after pasteurization is rapidly frozen in small wafers of approximately one-third of an ounce and stored in glass containers in a freezing-cabinet at a temperature of -15° F. In the slow-freeze method, the milk is frozen in units of 8-16 ounces, the freezing-time being 30-60 minutes. The hardening-compartment of an icecream-making machine may be used for the purpose. Detailed descriptions of these methods, as well as of fractional sterilization, are given in the article already referred to.

## 6. Organization

The organization of the breast-milk bank will depend on where it is sited and whether the milk is to be distributed outside the hospital. A medical committee should be formed to determine the policy in regard to the collection, pasteurization, storage and distribution. Especially is this necessary if it is likely that the supply will be less than

<sup>1</sup> [1 fluid ounce = 28.4 ml.—Ed.]

<sup>2</sup> [°F. = 5/9 (t - 32)°C.—Ed.]



## ANTIBODIES IN MILK

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- A Domestic Animals
  - 1 Absorption by the young
  - 2 Relation to globulin
- B Human colostrum and milk
  - 3 Absorption by babies
  - 4 Rh-antibodies
- References

### A. DOMESTIC ANIMALS

Antibodies do not pass through the placentas of the larger domestic animals; the young depend for passive immunity—which will protect them until they develop active immunity—on antibodies in colostrum or milk. Investigators (Famulener, 1912; Little & Orcutt, 1922; Mason, Dalling & Gordon, 1930; Schneider & Szathmáry, 1938) agree that colostrum is the main source. The concentration of antibodies in colostrum, before and immediately after the young are born, approaches or exceeds that in the serum of the mother, but later it falls rapidly. The ratio of the concentration in colostrum or milk to concentration in maternal serum may fall to 1:7 at 28 hours after delivery and to 1:8 to 1:20 at 4 days. But some antibody may persist in the milk up to at least 91 days (Mason *et al.* 1930).

Antibodies from species other than that of the mother also pass into the milk. Thus, if horse-serum containing diphtheria antitoxin is injected in a ewe before lambing, the concentration of antitoxin in the colostrum may, just after lambing, be as high as in the ewe's serum. Horse-serum containing diphtheria antitoxin was injected into a ewe on the 11th day after lambing; the ratio of concentration of diphtheria antitoxin in milk on the 12th day to the concentration in the ewe's serum was about 1:70. This ewe had been immunized before lambing by injection of formalinized culture of lamb-dysentery bacillus; the ratio of concentration of lamb-dysentery antitoxin, formed by the

ewe, in the milk of the 11th day, to the concentration in the ewe's serum, was 1:32 (Mason *et al.* 1930). Allowing for differences of methods of estimation, the two ratios do not differ significantly.

### 1. Absorption by the Young

Antibodies are found in the serum of the young shortly after ingestion of colostrum. In  $3\frac{1}{2}$  hours, the concentration in a lamb's serum may be about 1-10th the concentration in the ewe's serum; one day after birth, the concentration in the serum may be of the same order as in the mother's serum (Mason *et al.* 1930, Schneider & Szathmáry, 1938). If colostrum is withheld and milk, containing no antibodies, is given instead, antibodies do not appear in the serum. Calves can absorb antibodies directly from cow's serum, taken by mouth, on the first day after birth, but not on the 18th day (Smith, 1930). Mason *et al.* (1930) found that lambs could also absorb the diphtheria antitoxin of horse-serum, whether the horse-serum was injected into the ewe and secreted into the colostrum, which the lamb sucked, or given to the lamb direct by stomach-tube. But a far larger proportion of the antitoxin appeared in the lamb's serum if it was given subcutaneously than when it was given by the stomach. Lambs appear to be no longer able to absorb the antitoxin of horse-serum by the 4th day after birth; but there is evidence that calves can absorb antibodies formed by the cow and ingested in the mother's milk up to the 10th day (Mason *et al.* 1930).

### 2. Relation to Globulin

According to Graham, Peterson, Houchin & Turner (1938), the proteins of milk are formed mainly from the globulin of the mother's serum to form caseinogen and  $\beta$ -lactoglobulin<sup>1</sup>. The serum-globulin must be split into its constituent amino-acids and these must be rearranged. If globulin is split beyond the very earliest stages its specific properties as an antigen or, in the case of antibody globulin, as an antibody, are destroyed. But milk-globulin was shown by Wells & Osborne (1921) to be indistinguishable from serum-globulin by the anaphylactic reaction. Smith (1946a) separated two fractions which he called "immune globulin"<sup>2</sup> B and C from colostrum and from milk; he, also, found no difference, by the anaphylactic reaction,\* between this globulin and  $\gamma$ -globulin of cow's serum.

<sup>1</sup>  $\beta$ -lactoglobulin is the protein formerly known as lactalbumin. The term "globulin", as used in this article, does not include this fraction.

<sup>2</sup> The name is misleading, as it suggests that the whole of this fraction is antibody, of one sort or another, which is probably not the case.

### BREAST-MILK BANKS

*Continued from page 186*

the demand. In that case, it is essential that an order of priority should be set up. Careful records should be kept of the health of the donor and her child, the family history, the amount of breast-milk obtained, etc.

In the United States, the cost to the agencies varies from 10 cents to 35 cents an ounce. The payment to the donor varies from 5 to 15 cents an ounce, and is often supplemented by travelling-expenses and/or a meal. The charge to the consumer is usually on a sliding scale according to financial circumstances, the highest charge being in the region of 35 cents an ounce. In very few cases is the agency self-supporting. All the others have to be

subsidized in one way or another. At Queen Charlotte's Hospital donors are paid at the rate of two-pence [£0.008] an ounce. A charge of £0.5 a pint<sup>3</sup> is made for milk supplied for use outside the hospital. There, too, a similar difficulty is found in making the bank self-supporting.

The decision to establish a breast-milk bank must, therefore, depend on whether it is considered that the value of breast-milk to weakly infants so far surpasses that of cow's milk formulae as to justify the expenditure involved.

<sup>3</sup> [1 pint = 0.568 l.—Ed.]

The antibodies of cow's colostrum and of milk are precipitated within the same range of concentration of sodium sulphate as are those of cow's serum. The antibodies of cow's serum may be in the  $\gamma$ -globulin or in the T-fraction—a globulin formed on immunization, which has a mobility between those of  $\gamma$ - and  $\beta$ -globulin. The "immune globulins" of colostrum resemble the T-fraction of serum but differ slightly from it (Smith, Greene & Bartner, 1946). The T-globulin of cow's serum appears, therefore, to pass through the mammary gland, particularly in the earliest stages of lactation, with a slight but detectable alteration.

The concentration of globulin in colostrum is much higher in the first milkings than in later samples (Crowther & Raistrick, 1916). Smith (1946a) found about 13 g. of "immune globulin" in 100 ml. of the first sample of colostrum, with less in samples taken 10 hours later. In mature milk, the concentration of "immune globulin" is much less; it may rise considerably when the cow is hyperimmunized and the concentration of antibodies increases. The amount of globulin in milk, therefore, runs roughly parallel with the concentration of antibodies.

In the serum of newborn calves, the concentration of globulin, which is precipitated in the same range of concentration of  $\text{Na}_2\text{SO}_4$  as is that of colostrum, is very low. After ingestion of colostrum, the concentration of this globulin rises rapidly. This rise does not occur if colostrum is withheld (Orcutt & Howe, 1922). Jameson, Alvarez-Tostado & Sortor (1942) found that the serum of newborn calves contained no  $\gamma$ -globulin. A fraction corresponding to  $\gamma$ -globulin was detected at 18 hours, after the calf had suckled; by 36 hours the concentration of this fraction was as high as that of the  $\gamma$ -globulin of adult serum. The mobility of this fraction which appears in calves' serum during the first few days is about equal to that of the "immune globulin" of colostrum according to Smith (1946b); later the mobility falls. The globulin of serum, including antibody-globulin, is being changed continually (Schoenheimer, Ratner, Rittenberg & Heidelberger, 1942). The fall in mobility as the calf gets older may indicate the replacement of the "immune globulin" absorbed from colostrum by  $\gamma$ -globulin made by the calf itself.

According to Polson (1943), the serum of newborn foals contains very little  $\beta$ -globulin and no  $\gamma$ -globulin: after 5 days' suckling, the  $\beta$ -globulin has risen to the level found at 8 months, but the  $\beta$ -globulin is still very low. This recalls that Kekwick & Record (1940) found an increase of  $\beta$ -globulin in the serum of horses on immunization, although other investigators have found the antibodies in the  $\gamma$ -globulin or in a T-fraction with a mobility between those of the  $\beta$ - and  $\gamma$ -fractions (van der Scheer, Wyckoff & Clarke, 1940).

It appears, therefore, that newborn animals of certain species can absorb parts of the globulin or colostrum and of homologous or heterologous serum with little or no change. It is known that young animals can, in time, absorb enough of the protein of food, unchanged, to sensitize them (Wells & Osborne, 1921). But this absorption of the globulins of serum and milk differs quantitatively. For the amounts needed to sensitize are a matter of milligrams; while according to Orcutt & Howe (1922), the concentration of globulin in the serum of a calf may increase by 0.8 g./100 ml. in 14½ hours if, and only if, it

ingests colostrum; so that the calf must absorb some 8 g. of globulin in this time. This absorption of globulin is specific; for there is no evidence of the appearance in the serum of calves of a protein with the mobility of caseinogen (Jameson *et al.* 1942). This specific absorption is not explained by any physical properties of the globulin; for the "immune globulin" of cow's colostrum has a molecular weight of 160,000 to 190,000 and a low diffusion-constant (Smith, 1946a).

## B. HUMAN COLOSTRUM AND MILK

Human placentas and those of rabbits and guinea-pigs (Bourquin, 1922) allow antibodies to pass from the maternal to the foetal circulation. As the antibodies of human serum are contained mainly in the  $\gamma$ -globulin, this fraction is as high in the serum of newborn babies as in the mother's serum (Longworth, Curtis & Pembroke, 1945). Human colostrum, like that of other animals, contains more globulin than the later milk does. Few estimates have been made in the earliest samples of colostrum, when the concentration of antibodies is highest. One of the first investigators, Staubli (1906) found that the concentration of typhoid agglutinin in a sample of colostrum taken one day after delivery was considerably higher than that of the mother's serum. (Sugg 1935) found that the concentration of diphtheria antitoxin in the colostrum of a woman, who was highly immunized, was about 1/3 that in her serum. Liebling & Schmitz (1943) collected colostrum from 48 to 72 hours after delivery—that is, at a time when the concentration in the colostrum of a ewe or cow has fallen well below its maximum. They found the concentration of diphtheria antitoxin in the colostrum of 29 women who had been actively immunized was, with one exception, never more than 1/50 of the concentration in the mother's serum. Sugg found that the concentration in mature milk was 1/300 to 1/500 in the mother's serum.

### 3. Absorption by Babies

The concentration of antibodies in the serum of babies at birth is as high or higher than that in the mother's serum. It is, therefore, not possible to show whether the small amounts of antibodies present in the mother's milk are absorbed by the baby. There is, however, evidence that babies can absorb diphtheria antitoxin from horse-serum given by mouth (Escherich, 1897).

### 4. Rh-antibodies

As a human baby comes into the world provided with such antibodies as its mother can supply, which have passed the placenta, the presence of protective antibodies in milk and their absorption from the intestine is of little more than academic interest. But the presence of the harmful Rh-antibodies<sup>3</sup> in milk may be a serious matter. Witebsky & Heide (1943) found the titre of Rh-agglutinin in colostrum

<sup>3</sup>The Rh-antigen occurs in the erythrocytes of 85 % of people (Rh-positive) and is absent from the erythrocytes of the remaining 15 % (Rh-negative). The baby of an Rh-negative mother and an Rh-positive father may be Rh-positive. In this case the Rh-antigen may pass through the placenta into the mother's circulation and stimulate the formation of Rh-antibodies. These antibodies may enter the circulation of the foetus through the placenta (or, possibly, into the baby's circulation via the colostrum or milk) and cause the disease erythroblastosis foetalis, of which one of the outstanding features is lysis of the erythrocytes. Some Rh-antibodies, which are particularly harmful, and detectable only by special techniques, are called "incomplete" or "blocking" antibodies.

[For fuller accounts of the Rh factor, see *BMB* 420, 421, 872.—Ed.]

at 24 hours to be equal to that in the mother's serum. As a general rule, the concentration in later milk is lower (Langley & Stratton, 1944; Davidsohn, 1945). But concentrations equal to those in the mother's serum have been found by Fisk & Foord (1944) on the second day and by Davidsohn (1945) at a time not specified. Agglutinin has been found up to the 14th day by Langley & Stratton (1944). So far, no test has been made to detect the presence of incomplete, or blocking, antibodies, except that Gurevitch, Polishuk & Hermoni (1946), found agglutination in a specimen of colostrum taken before delivery, up to a dilution of 1:4, and conglutination up to 1:6 dilution.

Although the ratio of concentration of agglutinin in colostrum and milk to that in mother's serum may fall during the first two weeks, the actual concentration in the milk may change but little, because concentration of agglutinin in the mother's serum usually rises rapidly after delivery and reaches a peak after the 5th day. How much of the agglutinin of milk is absorbed by the baby is not known, and how far this agglutinin injures the baby is uncertain. It is generally supposed that it is harmful to

keep a baby with erythroblastosis foetalis at the breast (Hooker, 1941; Levine, Burnham, Katzin & Vogel, 1941). It appears that the harm caused by the anti-Rh-antibodies is not confined to the erythrocytes; it is possible that the intestinal tract may be damaged, although antibodies are not absorbed.

Agglutinins for cells of group A and B appear in the milk, after delivery, when the group of mother and baby are incompatible, as these agglutinins rise considerably in the mother's serum during the second week after delivery (Boorman, Dodd & Mollison, 1945). The concentration of A-agglutinins in milk may be very high (Davidsohn, 1945). It appears that these antibodies may be absorbed in some cases and cause hæmolytic disease that begins several days after birth.

The extent to which babies can absorb antibodies is of some practical interest. It might be tested by feeding babies with colostrum from a woman, not its mother, who has a high concentration of some harmless antibody, such as typhoid agglutinin, in her serum.

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## EXCRETION OF DRUGS IN MILK

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- 1 Nicotine
  - 2 Sulphonamides
  - 3 Sedative drugs
  - 4 Purgatives
  - 5 Other substances
  - 6 The milk of animals
- References

The excretion of drugs in milk is not an easy subject for study since the nursing mother is unwilling to lend herself for experimental observations, and the cow is too large. An opportunity exists for someone to study the excretion of drugs in the milk of the goat. There are, however, a few statements in text-books for which little evidence is quoted; thus Holt (1940) says

"A number of drugs may be eliminated in the milk, particularly when full doses are given or after prolonged administration. Atropine, many of the opium derivatives, mercury, lead, arsenicals, salicylates, iodides, bromides, and some of the alkaloid cathartics have all been found in the milk, sometimes in sufficient quantities to produce symptoms in the nursing child."

## 1. Nicotine

Several workers have attempted to throw light on the question whether a nursing mother should smoke. Hatcher & Crosby (1928) found that nicotine injections (0.5 mg./kg.) suppressed the milk of a cat and of a cow, but that the milk showed only a trace of nicotine. Similarly, in a woman who began to smoke 2 days post-partum, and smoked 20-25 cigarettes daily for 6 days, secretion of milk was abundant at first but decreased rapidly during the last two days. A sample was collected with difficulty after 7 cigarettes had been smoked in 2 hours. The total amount of nicotine in the milk did not exceed 0.015 mg., though there was unquestionably a trace present. This evidence suggests that smoking reduces the milk-yield.

Emanuel (1931) likewise investigated the milk of mothers who smoked, to determine the nicotine present. After smoking 7-15 cigarettes a maximum of 0.03 mg. nicotine/litre of milk was found. Nicotine could be demonstrated in the milk 1-2 hours after smoking, but the main excretion occurred 4-5 hours later. A more detailed examination was made by Perlman & Dannenberg (1942), who observed that the concentration of nicotine found in the milk increased with the number of cigarettes smoked. For heavy smokers (11-20 cigarettes a day or more), it was as high as 0.4-0.5 mg./litre. The evidence did not suggest any connexion between the extent of smoking and the size of the milk-

supply; there were, however, only 55 mothers in all. The authors say "It is our impression that the number of mothers who smoked and failed to nurse their infant successfully was no greater than in the non-smoking group in this hospital." The babies were apparently unaffected by the nicotine in the milk, even when the amount was as high as 0.75 mg./litre. All the babies of the heavy smokers gained weight, while several in the other groups lost or did not gain weight. From this, it seems clear that nicotine in the milk is not sufficient to disturb the baby of a mother who smokes, even if she smokes heavily.

## 2. Sulphonamides

The presence of sulphanilamide in milk was observed by Adair, Hesseltine & Hac (1938), who gave their patients a total dose of 2 or 4 g. sulphanilamide orally (Table I), and withdrew their milk at 4-hourly intervals. Among 10 who received 2 g. of the drug, the total excreted in the milk varied from 3.8 to 13.7 mg. over 3 days. Among 10 who were given 4 g., the variation was from 11.7 to 54.0 mg. The authors found that the amount of drug excreted was not related to milk-volume, and that in some patients whose urinary excretion of the drug was poor a proportionately larger amount of sulphanilamide was eliminated in the milk. The concentration of sulphanilamide in the milk was higher than that in the blood, and the drug continued to be excreted in the milk long after the amount in the blood was negligible. However, the blood-concentration represents the balance between the amount entering and the amount leaving the blood at any moment, while the milk-concentration is the accumulation of 4 hours.

TABLE I. FREE SULPHANILAMIDE (mg.) EXCRETED IN MILK

		(Milk of 10 human subjects)			
		1st day	2nd day	3rd day	Total
2 g.-group	...	5.18	3.31	0.57	9.06
4 g.-group	...	19.25	11.79	2.41	33.45

Similar experiments were carried out by the same authors (1939) to determine the amount of sulphanilamide excreted in milk when therapeutic concentrations were maintained in the blood for three days. They found that the amount of sulphanilamide in the milk depended on the size of the dose, but that the total amount of drug excreted over 5 days was never more than 1.6 % of the dose.

Pinto (1938) obtained results in 3 patients in whom the concentration of sulphanilamide in milk was very similar to that in the blood and not only rose, but even fell with it. The only difference was that the peak of concentration in milk occurred later than that in the blood, both of the sulphanilamide itself and of the acetylated form. When the concentration in the blood fell, that in the milk fell also, the sulphanilamide presumably diffusing back into the blood. Pinto calculates that even if the concentration in the maternal blood was maintained at 10 mg./100 ml. during the 24 hours, the maximum amount received by a baby taking 1200 ml. milk per day would not be more than 0.12 g. sulphanilamide and 0.16 g. acetylsulphanilamide.

### 3. Sedative drugs

The excretion of barbitone in milk was studied by Kwit & Hatcher (1935), who failed to find it after giving a dose of 10 grains (0.65 g.); their method was sufficiently sensitive to detect 1 part in 25,000. Tyson, Shrader & Perlman (1938a) found phenobarbitone in 23 out of 37 samples of milk from 10 mothers who were receiving 2 grains daily, but there was no evidence of any effect on the babies. Mayo & Schlicke (1942) found pentothal in milk when they excised a branchial-cleft cyst from a woman 12 days post partum. Fourteen minutes after the injection of pentothal had ceased, milk from the right breast had a barbiturate concentration of 2.00 mg./100 ml.

Kwit & Hatcher also investigated the behaviour of morphine and codeine. After giving 16 mg. morphine subcutaneously, a trace of morphine, less than 0.1 mg., was found 4 hours later. Terwilliger & Hatcher (1939) described a woman morphine-addict, whose child showed apparent signs of addiction. But although the woman was receiving 128 mg. daily by injection, at no time did her milk show more than a trace of morphine. Kwit & Hatcher observed that codeine was not excreted in the milk at all, even after the oral administration of 32 mg. every 4 hours until 192 mg. had been given.

The same workers examined sodium bromide. A total of 15 g. was given to each of 2 patients in doses of 1 g. five times daily. 21 samples of milk were taken over 6 days. The first sample from one patient, and the first and second from the other did not yield bromide, but the other 18 samples did. Nearly 8 mg. were obtained from one sample, and most of the others yielded 2 mg. Thus mild bromism might result from babies drinking the milk of mothers taking sodium bromide. Van der Bogert (1921) reported a papulo-pustular eruption which developed in a child from this cause, and stated that "more than a trace" of bromide was discovered in the milk. Tyson, Shrader & Perlman (1938b) gave 10 women 6 g. sodium bromide daily for 3-5 days. Bromide was found in 37 out of 38 samples of milk, and there was clinical evidence of bromism in 4 of the babies, who were drowsy, and one had a rash.

### 4. Purgatives

Tyson, Shrader & Perlman (1937) have also examined the passage of purgatives into milk, recording the daily motions of mother and child, the purgative being given on the 5th day post partum. Aloin affected the bowels of 11 out of 33 babies, though evidence of aloin in the milk was obtained in only 7 out of 11 patients tested. Phenolphthalein affected the bowels in 10 out of 25 children, though there was no evidence of it in the milk. Kwit & Hatcher likewise found no phenolphthalein in breast-milk after giving 1.5 grains [100 mg.], and the finding of Tyson, Shrader & Perlman that the babies' stools were affected is surprising in view of the frequency with which phenolphthalein is given to nursing mothers. These authors found no senna or rhubarb in milk, and rhubarb had no effect on the babies. Calomel affected 2 out of 4 babies.

### 5. Other Substances

Unlike sodium bromide, iodide does not appear to enter the milk. Kwit & Hatcher found extremely small amounts

of potassium iodide in samples of milk obtained after giving 3.8 g. on one occasion and 4.6 g. on another. Pommerenke & Hahn (1943) administered 65 mg. of radioactive sodium as the chloride, in orange juice, to four nursing mothers. Appreciable amounts of radio-sodium were recovered within 20 minutes of ingestion. In 2 hours (when the peak of excretion was reached) from 0.5-1.3 % of the amount fed/litre of milk had been recovered, the secretion subsequently diminishing.

Sodium salicylate and quinine are substances which are often taken over long periods, and might enter the mother's milk. Kwit & Hatcher gave 4 g., 2 g., 1.2 g. and 0.6 g. sodium salicylate to four patients in divided doses. Extracts of the milk collected 4 hours after the last dose contained from 1 mg. to 0.02 mg. sodium salicylate respectively, which are negligible amounts. Terwilliger & Hatcher gave 5 doses of 300 mg. each of quinine sulphate to two lactating women, and 7 doses of 640 mg. each to four women. Traces of quinine were found in the milk in every instance, in one case 30 minutes after ingestion. None was found 24 hours after administration. The amount recovered was once as high as 0.32 mg., but was generally of the order of 0.01 mg. or a trace.

### 6. The Milk of Animals

Observations have been made in two directions in animals. It is known that oestrogenic substances can be used to bring heifers into milk which have failed to become pregnant. Stilboestrol has been used in this way: tablets have been implanted under the skin and daily injections have also been used. It was naturally of importance to observe whether an oestrogen appeared in the milk itself. Lawson, Stroud & Williams (1944) showed that hexoestrol could actually be demonstrated in the milk of heifers, but they found that the amount was as little as 1 microgramme per pint (568 ml.) even when a tablet of 1 gramme was implanted.

The introduction of DDT as an insecticide to be sprayed on foliage has raised the question of whether cattle will suffer if they eat the foliage, or whether their milk will be toxic to those consuming it. Woodard, Ofner & Montgomery (1945), experimenting on the accumulation of DDT in the body-fat of dogs, found 0.06 and 0.04 mg. DDT per gramme of milk on two successive days in a bitch receiving 80 mg./kg./day of solid DDT. Telford & Guthrie (1945) gave food containing 0.1 % DDT to 3 rats with a day-old litter. Typical tremors occurred in the mothers and young and by the 18th day all except one mother and one nursing were dead. These two were placed on a normal diet and recovered. Nine adult rats fed on milk obtained from goats which were receiving 1 g. DDT/8-9 pounds [3.6-4 kg.] body-weight died with symptoms of DDT poisoning. Likewise, DDT poisoning exhibited by parturient rats fed on goats' milk from DDT-fed animals was passed on to the young of the rats. However, young goats suckling from DDT-fed mothers showed no ill-effects. But butter made from milk of DDT-fed goats and fed to rats produced DDT tremors. The authors concluded that intensive research was necessary on the toxicity of milk from cows ingesting DDT-sprayed foliage.

*Continued at foot of page 192*



## MILK-BORNE DISEASE IN BRITAIN

## A Brief Survey of the Position during Recent Years

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- 1 Bovine tuberculosis
  - 2 Typhoid and paratyphoid fevers
  - 3 Salmonella food-poisoning infections
  - 4 Dysentery
  - 5 Undulant fever
  - 6 Streptococcal infections
  - 7 Staphylococcal food-poisoning
- References

Milk-borne diseases are still very much in evidence in Britain, and although undoubted progress has been made towards their elimination a great deal has yet to be accomplished to diminish their unnecessary prevalence. The subject arouses almost perennial controversy and discussion in the legislature, and in the medical and lay press, and will no doubt continue to do so until an entirely satisfactory method of control has been established. At the Annual Representative Meeting of the British Medical Association in 1945 this matter was again ventilated and attention was called to the urgent necessity for instituting measures of control. An editorial article which appeared in the *British Medical Journal* (1945) reviewed the position. It said that in 1943 the Government announced in a White Paper its intention of controlling the quality of the milk by making it impossible to sell milk in areas scheduled by the Minister of Food unless it was either heat-treated or obtained from disease-free dairy herds. Further, a Defence Regulation, issued in January 1945, specified certain milks which might be sold in specified areas but did not specify the area.

In April 1946, a debate on this subject took place in the House of Lords. One speaker put the yearly number of deaths from drinking tuberculous milk at 1,600 and the number of casualties at 7,000 to 8,000, to say nothing of other types of infection. The Government spokesman replied that the annual consumption of liquid milk in England and Wales was 1,075 million gallons<sup>1</sup> and of this 725 millions were heat-treated. Again, at the Annual Representative Meeting of the British Medical Association in July 1946, a resolution was adopted to the effect that the Council of the Association insisted that the Minister of Health and the Minister of Food should secure legislation immediately requiring all milk for human consumption to be pasteurized. Chalmers (1946) described how attempts have been made in Scotland to encourage the production of clean milk by increased premiums. In 1944 the premium for milk obtained from tuberculin-tested herds was increased to fourpence [£0.017] per gallon, and in 1945 arrangements were made whereby dairymen holding a licence under the Milk (Special Designation) Orders (Scotland) 1936-1944 to sell milk as "Pasteurized" or "Heat-treated" would receive a premium of one half-penny [£0.002] a gallon in respect of milk sold under one or other of these designations.

During the past few years several books have been published dealing with milk-production and milk-borne diseases. *The pasteurization of milk* by Wilson (1942) gives a very full account of the pros and cons of this vexed question. The book includes chapters on milk-borne infections, methods of rendering milk safe, and an account of the effects of pasteurization on the nutritive value of the milk, and it presents conclusive evidence on the need for the elimination of milk-borne disease. *This milk business* by Enock (1943), who is a mechanical engineer, deals largely with the various types of plant available for pasteurization, and advocates the "in-bottle" method, but one chapter is devoted to milk-borne diseases. *Pasteurisation* by Hill (1943) discusses the necessity for pasteurization and answers criticism of this method of making milk safe. The rest of the book is devoted to a discussion of the technical matters connected with pasteurizing plants and the methods of checking their efficiency.

## 1. Bovine Tuberculosis

Bovine tuberculosis is probably the most serious of all our milk-borne infections. There is an immense reservoir of possible sources of infection, and the means of eliminating

<sup>1</sup> [1 gallon = 4.54 l.—Ed.]

## EXCRETION OF DRUGS IN MILK

*Continued from page 191*

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them by pasteurization are available only in urban areas. The report of the Committee on Tuberculosis in War-time of the Medical Research Council (1942) calls attention to the fact that at least 40% of cattle throughout Britain give a positive tuberculin-test, although the percentage of reactors varies in different areas, and that at least 6% of farm milk-supplies contain tubercle bacilli.

There has been a very definite increase in non-pulmonary tuberculosis, particularly in young adults, during the war, but there is little evidence to prove that the bovine type of tubercle bacillus has had an increased prevalence in these cases. Griffith & Munro (1944) summarized the literature on the bovine type of pulmonary infection. These investigations showed that in Scotland, out of a total of 2,769 cases examined, no less than 160 (or 5.7%) showed a bovine type of infection. In England, on the other hand, where 4,194 cases were typed, only 81 (or 1.9%) showed the bovine bacillus. Cutbill & Lynn (1944) tried to determine the mode of infection in 48 cases of bovine pulmonary tuberculosis, as shown in table I.

TABLE I. PROBABLE MODE OF INFECTION IN 48 CASES OF BOVINE PULMONARY TUBERCULOSIS

Mode of infection	Number of cases	%
Alimentary ... ..	16	33
Air-borne contact with cattle	10	21
Air-borne familial contact...	3	6
No evidence obtained ...	19	40
Total ... ..	48	100

Again, from the evidence collected by Griffith & Munro (1944) it would appear that in England and Wales about one-quarter of the cases of bovine pulmonary tuberculosis are infected through the intestinal tract and in Scotland about one-third of such cases.

As regards the incidence of the bovine type of bacillus in the various lesions of surgical tuberculosis, little fresh has been added to the exhaustive statistics produced by Griffith (1938). Two methods have, however, been suggested for the determination of the number of deaths due to the bovine type of bacillus. The first is that used by the Cattle Diseases Committee (1934) and this argues that, since the frequency with which the bovine type of bacillus is found in different clinical forms of tuberculosis is known, it is possible to estimate the deaths from the figures given in the Registrar-General's Annual Report. Wilson (1942) suggests the following alternative:—in the Administrative County of London where practically all milk is heat-treated, primary infection of bovine origin is no longer possible. All patients with non-pulmonary tuberculosis must, therefore, be infected with the human type of bacillus, and if in London a given number of cases of pulmonary tuberculosis are associated with a given number of cases of non-pulmonary disease, it is a simple matter to calculate how many non-pulmonary cases should be associated with pulmonary cases elsewhere in England and Wales. The

difference between the calculated number of human infections and the total of recorded cases gives the number of bovine infections.

In an interesting paper, Lethem (1946) gives almost conclusive evidence of the value of pasteurization. The author points out that abdominal tuberculosis in young children is mainly due to the bovine type, whereas in most other non-pulmonary lesions the human variety occurs more frequently. Further, by 1939 the proportion of heat-treated milk had risen in London to 98%, whereas in other urban areas only 35% to 60% was pasteurized. The effect of this on the death-rate from abdominal tuberculosis is shown in table II.

TABLE II. ABDOMINAL TUBERCULOSIS: DEATH-RATE PER MILLION CHILDREN UNDER 5  
[actual number of deaths in brackets]

Area	1921	1933	1935	1944
Administrative County of London	136(51)	24(8)	12(3)	6(1)
Combined County Boroughs	437(490)	157(166)	63(57)	35(32)
Combined Urban Districts	366(370)	134(370)	77(66)	42(14)
Combined Rural Districts...	252(176)	92(57)	63(61)	60(37)

The most significant fact is that in 1944 the death-rate for abdominal tuberculosis in London was only one-tenth of that in rural districts.

## 2. Typhoid and Paratyphoid Fevers

The investigational aspects of typhoid and paratyphoid fevers as milk-borne diseases have been very fully dealt with in a paper by Scott (1941). Again, further advances in phage-typing methods have been reported by Felix (1943) and by Felix & Callow (1943), and the development of phage-typing of both *Salm. typhosus* and *Salm. paratyphosus* B has been of great assistance in epidemiological investigations. Felix has stated that without this new laboratory-aid there can be little hope of determining the source of infection of many of the sporadic and small groups of cases that occur throughout the country. This is amply demonstrated in a paper by Bradley (1943) on the results of an investigation of an outbreak of 21 cases of typhoid fever which occurred during a period of 18 months and which were spread over different counties in the south of England. Eventually a small outbreak due to type D4 typhoid bacilli occurred on a farm where the farmer himself was found to be a carrier. It was then possible to associate the previous cases, which were also infected with type D4 bacilli, with this source, and to prove that this particular milk-supply was the vehicle of infection. At Kettering, paratyphoid epidemics had occurred in 1927 and 1936, while in 1940, 222 more cases were diagnosed and reported by Hogg & Knox (1941). The source of infection in this outbreak was cream-cakes from one bakery, where it was found that out of 32 male employees no less than 10 showed evidence of infection. The possibility of infecting milk through contaminated water used for washing utensils and dairy purposes generally has always to be kept in mind, and Parry (1942) has recorded such an outbreak in which *Salm. typhosus* was recovered

from the water. The epidemiology of paratyphoid fever has been studied extensively by Savage (1942). He believes that the incubation period in paratyphoid fever is fairly variable, that the disease may in some instances start with symptoms resembling a food-poisoning infection, and that the death-rate associated with it is very low. As regards spread, he believes that the transitory carrier is more important than the chronic one. During the past year also, two extensive outbreaks, one of typhoid at Aberystwyth, and the other of paratyphoid at Coatbridge, have been due to infected ice-cream. The Ministry of Health has prepared and issued a Draft Order (Ice-cream (Heat Treatment) Regulations, October 8, 1946), which will require the ice-cream mixture to be pasteurized before freezing. The possibility of setting up a bacteriological standard for the purity of ice-cream is also under consideration.

### 3. Salmonella Food-Poisoning Infections

Recent research on the antigenic structure of members of this group has added much to our knowledge, particularly in regard to their prevalence, their distribution in various countries, and the sources with which they are normally associated. In fact, the members of this group have become so numerous that for the identification of the more unusual types recourse must usually be made to the services of the Salmonella Typing Centre, which are available through the Central Public Health Laboratory in London. One paper by Bridges & Taylor (1944) gives details of various technical methods which can be employed for identification. Various workers have demonstrated that in calves and cattle the two most common *Salmonellas* are *Salm. dublin* and *Salm. typhimurium*, while *Salm. enteritidis* and *Salm. enteritidis* var. *rostock*, which are closely allied to *Salm. dublin*, are less frequent. Conybeare & Thornton (1938) published a report on a milk-borne *Salm. dublin* outbreak of gastro-enteritis in 100 individuals, and at the same time summarized the literature on this subject. Tulloch (1939) recorded two outbreaks of a similar nature which had occurred in Dundee some years previously. More recently, Sutherland & Berger (1944) described a further outbreak due to *Salm. dublin* in Yorkshire, involving 162 persons where the bulk-milk from the farm which was the source of supply contained *Salm. dublin*, but the milk from the individual cows did not. The faeces, however, from one cow were found to be positive.

### 4. Dysentery

During the early war-period there was a high prevalence of bacillary dysentery infections amongst the general population, but more recently there has been a considerable decline in its incidence. The most frequent type of infection was that due to *B. dysenteriae* Sonne, but infections with *B. dysenteriae* Flexner were also quite numerous. Faulds (1942, 1943) described two outbreaks of Sonne dysentery in Cumberland. One involved 43 out of a total of 72 customers supplied by a small farm, and the other involved 120 individuals who received their milk from a retail dairy. In the first instance, workers on the farm had had Sonne dysentery, and in the second, individuals at one farm which supplied part of the milk and two workers at the retail dairy were found to have the infection. Nisbet (1944) described another outbreak at Kilmarnock which involved 90 persons,

and Rae & Smith (1945) reported a large outbreak of 252 cases. In this latter outbreak, 60 gallons of pasteurized milk were retailed at a dairy, where it was found that three members of the dairyman's family and one adolescent male worker had had symptoms of dysentery. Specimens of faeces from these individuals repeatedly showed *B. dysenteriae* Sonne.

### 5. Undulant Fever

The presence of brucella organisms in milk continues to be investigated. Thus, Duke (1940) recovered an organism from the milk of an accredited herd of 76 cows which gave all the cultural and serological characteristics of the *melitensis* variety. Further examination of the individual cows showed that 3 animals were excreting this organism. Again, Menton (1940) has examined 1,000 milk-samples from the Midlands of England, and of these 34.5% showed whey agglutinations. When, however, these samples were inoculated into guinea-pigs, only 29.1% showed the presence of *Br. abortus*, but on the other hand 9.1% of samples which showed no agglutinins contained living *Br. abortus*. The sera of the guinea-pigs were examined at 3-, 6-, and 9-weekly periods after inoculation, and this method was found to give a higher percentage of positive results than if only one examination had been made at 6 weeks. Again, Jones (1943) examined bulk milk-samples obtained in the Liverpool and Kent areas, with the following results:—

Years	Number of samples	Number positive	% positive
1933-34 ...	314	48	15.2
1939-40 ...	408	59	14.2

There was some indication of a higher incidence of *Br. abortus* in January and a low incidence in August, but when samples were obtained from an individual cow or from small groups of cows this seasonal variation was not in evidence.

Despite the fact that a fair percentage of milk contains *Br. abortus*, the incidence of human infections is very low. Thus, the Annual Report of the Chief Medical Officer of the Ministry of Health for 1938 (1939) gave the total number of reported cases between 1926 and 1938 as only 474, but within the past few years several small outbreaks have been noted. Elkington, Wilson, Taylor & Fulton (1940) described an outbreak in which 26 out of a total of 400 boys at a boarding-school had a febrile illness, and of these 10 gave a positive agglutination-test. Cruickshank & Stevenson (1942) reported that in another boarding-school, 4 out of 54 girls between the ages of 7, 9 and 17 years, with a staff of 14 teachers and maids, had been infected from unpasteurized milk. Finally, in a third school at North Molton (*Monthly Bulletin of the Ministry of Health & Emergency Public Health Laboratory Service*, editorial, 1942), 4 girls between 9 and 16 years developed the disease.

### 6. Streptococcal Infections

There is little doubt now that when a milk-borne epidemic of scarlet fever or streptococcal sore throat does occur, the milk has been contaminated as the result of a streptococcal mastitis, the infection having been transmitted to the cow from human sources. These outbreaks are invariably due to Lancefield's Group A strains, which are infrequent pathogens in the cow, while on the other hand Lancefield's

Group B strains, which cause a widespread incidence of mastitis in milk-cows, are only rarely associated with human infections. Allison (1942) has summarized the reports in this latter type of infection. He has noted that 47 human infections were associated with pregnancy and 9 with endocarditis.

As regards Group A *Str. pyogenes* infections, Douglas, Smith, Sutherland & Watson (1942) recorded an outbreak which occurred at Elgin. Between 13 January and 2 March, 1939, in this town of 900 inhabitants, 214 cases of scarlet fever were notified, but many cases of sore throat also occurred. The peak day of the epidemic was 26 January, when 31 cases were reported. The common food-factor amongst the primary cases was the milk-supply from a registered herd of 100 cows, 68 of which were in milk. By examination of the milk it was shown that one cow was excreting large numbers of haemolytic streptococci from one quarter of the udder. The strain isolated from the cow, and 10 strains of haemolytic streptococci isolated from patients, all belonged to Lancefield Group A and Griffith's type 3. Dublin, Rogers, Perkin & Graves (1943) published a paper on streptococcal outbreaks in various countries in which the organism had been typed serologically, and showed that type 3 was more frequently found than any of the others.

## 7. Staphylococcal Food-Poisoning

Few papers are published in Britain compared with the USA on outbreaks of staphylococcal food-poisoning. This is probably due to the fact that their occurrence in Britain is less frequent, but it is difficult to say to what this can be ascribed. The vehicle of infection in the USA

is often cream-filled cakes, whereas in the occasional British outbreaks, cooked meats seem to be more often involved. Phage-typing of staphylococci as developed by Wilson & Atkinson (1945) has demonstrated 21 different types, and this has proved of value in epidemiological problems associated with food-poisoning. In fact this method of investigation would probably afford more satisfactory evidence of the connexion between the infected food and the illness of patients than determining whether or not a staphylococcus produces an enterotoxin. Macdonald (1944) has published an account of a small outbreak due to cheese made from goat's milk. Five individuals had supper shortly after 6 p.m. one evening, and between 10 and 11 p.m. four had diarrhoea, abdominal pain, and dizziness. Strains of staphylococci obtained from the faeces of one patient, from three samples of cheese, and from the milk of the goat, all appeared to be identical.

\* \* \*

The problem of milk-borne disease could be solved so far as urban areas are concerned by the introduction of compulsory pasteurization. It is, however, admittedly more difficult to make this applicable to rural communities. A further need is the provision of a more complete veterinary service which would provide for a proper survey of diseases in cattle, and then proceed to tackle these in a systematic fashion. The present method in Britain of trying to stimulate the production of clean milk by awarding bonuses for various classes of milk is no doubt of benefit economically, but it does not provide the safeguard that the milk is free from human pathogens.

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## BACTERIOLOGICAL CONTROL OF MILK

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- A Methods of milk-testing
    - 1 Plate-count test
    - 2 Dye-reduction tests
    - 3 Presumptive coliform-test
    - 4 Keeping-quality tests
  - B Role of laboratory tests in milk-control
    - 5 Control of milk distributed raw
    - 6 Control of milk which is heat-treated before distribution
  - C Methods of assessing the sterility of milk-equipment
- References

This discussion will be confined to those aspects of bacteriological control that are concerned with the cleanliness or keeping-quality of milk, and will not deal with the problem of safety or freedom from pathogenic bacteria. These two aspects of milk control are distinct and must not be confused.

Most of the bacteria which lead to poor keeping-quality are added to milk after it is withdrawn from the udder. Their numbers can be controlled by the adoption of clean methods at milking-time, by the use of clean sterile equipment in which to handle the milk, and by efficient cooling to prevent too-rapid proliferation.

Pathogenic bacteria of bovine origin, and occasionally from human sources (Bendixen & Minett, 1938), may be present in milk before it is withdrawn from the udder. Infection during subsequent handling from human cases or carriers of disease, contaminated water-supplies, or other extraneous sources, may also occur. Clearly therefore, precautions which may be adequate to ensure milk of satisfactory keeping-quality will not suffice to ensure its safety.

### A. METHODS OF MILK-TESTING

There are numerous methods in use in different countries which are designed to give, by direct or indirect means, a measure of the cleanliness or keeping-quality of milk. No two milk-samples contain exactly the same number or types of bacteria and it is hardly to be expected that different methods of testing will give exactly the same answer. Moreover, no single test can give complete information about the bacteria in milk, and tests which are suitable for one particular purpose may be entirely inadequate for another.

Results by the same tests may be expected to vary widely unless standard techniques are rigidly observed. In this connexion, the need for some system of regular supervision of laboratories making official milk-analyses is emphasized by

the results of a comprehensive survey of such laboratories in 40 States in the USA by Black (1943). None of the 281 laboratories surveyed followed implicitly the official methods prescribed (American Public Health Association, 1941). Realizing the importance of this factor, the Ministry of Agriculture and Fisheries has made provision (1944b) for the regular supervision of all laboratories engaged in making bacteriological tests of milk-samples under the National Milk Testing and Advisory Scheme.

The age of the milk and its temperature of storage have such a profound influence on the bacteria present, that the results of any test can have no possible meaning unless these factors are taken into account. When the temperature is favourable, bacteria in milk are in a constant state of change. Even in fresh milk, in which the bacteria are in the lag-phase and show no increase in numbers, respiratory and metabolic changes proceed, so that reduction-time measured by dye-tests, and keeping-quality may be expected to be shorter at the end than at the beginning of the lag-phase (Wilson, Twigg, Wright, Hendry, Cowell & Maier, 1935).

The figures in Table I for 23 samples of morning milk maintained at different temperatures from 11 a.m. on the day of production until 9 a.m. on the following morning emphasize the magnitude of the effect of temperature of storage on the bacterial count.

**TABLE I. CHANGES IN THE COLONY-COUNT [30° C.] OF 23 SAMPLES OF RAW MILK STORED FOR 22 HOURS AT DIFFERENT TEMPERATURES**

(Geometric mean count before storage : 32,360)

Storage temperature (°C.)	Geometric mean count (per ml.)
2—5	26,310
10	69,180
14	512,900
18	2,754,000
22	28,180,000

The effect of temperature varies markedly according to the type and number of bacteria gaining access to milk at the time of its production. Thus, milk which has been carefully produced and contains a small number of bacteria will deteriorate less rapidly than milk which has been less carefully produced (Table II).

**TABLE II. THE EFFECT OF STORAGE FOR 22 HOURS AT DIFFERENT TEMPERATURES ON THE COLONY-COUNT, METHYLENE-BLUE RESULT, AND KEEPING-QUALITY OF TWO RAW-MILK SAMPLES OF DIFFERENT INITIAL BACTERIOLOGICAL QUALITY**

Storage-temperature (°C.)	Sample A			Sample B		
	Colony-count (30°C.)	Methylene-blue test at 37°C. (hours)	Keeping-quality at 18°C. (hours)	Colony-count (30°C.)	Methylene-blue test at 37°C. (hours)	Keeping-quality at 18°C. (hours)
2—5	1,900	11	46	41,000	7½	38
10	1,720	9½	44	48,000	7½	34
14	15,100	8	40	110,000	6½	26
18	500,000	6½	26	2,420,000	3	18
22	1,700,000	1½	22	16,600,000	1	6



Low atmospheric temperatures during winter, by restraining the multiplication of bacteria on the utensils between milkings as well as in the milk itself, render the task of supplying the consumer with milk of satisfactory keeping-quality relatively easy, whereas during hot weather in summer the keeping-quality of any but the most carefully produced milk may be unsatisfactory unless it is well cooled, or better still refrigerated.

Neglect, in interpreting the results of bacteriological tests, of the effect of temperature to which samples are exposed and the time of exposure has led to a great deal of misunderstanding. Clearly there can be no agreement between the results obtained in different laboratories without due regard to the overpowering effect of these two important factors (Mattick, McClellmont & Irwin, 1935).

The choice of time and temperature of storage of samples before testing must largely depend on the object of the examination. If a measure is desired of the initial contamination of the milk, then samples should either be tested immediately or stored at a constant temperature until the test is begun. If on the other hand, as is more usual, a measure is required of the bacteriological quality of milk as delivered to the consumer or to a dairy for processing, the combined effect of the initial contamination and temperature of storage pending delivery must be taken into account, and samples should be taken at the time of delivery.

It must be emphasized, however, that tests made at the time that milk is delivered to the consumer may fail to indicate its subsequent behaviour. Thus, two milks which give identical results at the time of delivery may behave quite differently during subsequent storage, according to the temperature to which the milk has been exposed before delivery. Deterioration in the hands of the consumer may be gradual in milk which has been carefully produced but stored at atmospheric temperature until delivered, whereas milk which has been badly produced, but in which proliferation of bacteria has been suppressed by refrigeration before delivery, may deteriorate rapidly when stored at atmospheric temperature by the consumer.

A new approach to the problem of ensuring that test-results reflect the keeping-quality of milk in the hands of the consumer is apparent in the official tests which have recently been prescribed in Britain for heat-treated and pasteurized milk (Statutory Rules and Orders, 1944a; 1944b; 1946). Samples taken during delivery are stored at atmospheric temperature until between 9 and 10 a.m. on the following morning and then tested by the  $\frac{1}{2}$ -hour methylene-blue test. Since milk is stored under conditions simulating those to be found in the average British household, that which satisfies the test can be expected to remain sweet until it is utilized.

Of the numerous tests which are in use for estimating the bacteriological quality of milk, consideration will be confined to those which are in general use in Britain.

### 1. Plate-Count Test

In the field of dairy bacteriology there is no other test which has been so widely used and so severely criticized as the plate-count. Until 1937 it was the official method for testing designated raw and pasteurized milk, but in that year it was replaced by a methylene-blue test for the examination of designated raw milk, and in 1946 by a modified form of methylene-blue test for the examination of pasteurized milk. In spite of its many shortcomings, the test is still widely used

unofficially. For certain purposes, including the detection of thermophilic bacteria in raw and pasteurized milk, and for evaluating the sterility of milk-equipment, there is no satisfactory substitute.

If the plate-count is to be of any value, its limitations must be clearly understood. It does not give exact information as to the number of living bacteria in milk. Many of the bacteria occur in clumps, and those which develop into colonies are recorded as single organisms. Moreover, many of the bacteria in milk are fastidious in their growth-requirements and may fail to form colonies in the medium used for plating. Thus, addition of 1% sterile milk to the medium leads to increased counts with both raw (Hiscox, Hoy, Lomax & Mattick, 1932) and pasteurized milk (Anderson & Meanwell, 1933).

Counts are seriously affected by the temperature of incubation of plates. Even slight differences in incubation-temperature may affect the count (Pederson & Yale, 1934; Yale & Pederson, 1936). Maximum counts are usually obtained when plates are incubated at 30-32°C. (Yale, 1938; Hempler, 1940) and not at 37°C., but even at the lower temperature many bacteria in milk may fail to form colonies. Incubation at the lower temperature not only leads to higher counts, but for some purposes may be essential to ensure a true assessment of the bacterial flora. This is particularly the case with milk and milk-products that are, during processing, subjected to some form of heat-treatment (Abd-El-Malek, 1943; Hiscox, 1945).

Wilson (1935) favoured incubation of plates at 37°C., but so little information of a public-health value is afforded by the plate-count that this view can hardly be justified, bearing in mind the additional information that may be derived when plates are incubated at 30-32°C.

The main objection to the use of the plate-count for official control purposes is the very large error of estimation inherent in the method even when prescribed technique is closely observed (Malcolm, 1932; Mattick *et al.*, 1935; Wilson, 1935; Barkworth, Irwin & Mattick, 1941). Wilson (1935) estimated that the error of a single determination may be of the order of  $\pm 90\%$ , so that the true count of a sample with a recorded count of say, 100,000 per ml. may be expected to be somewhere between 10,000 and 190,000 per ml.

### 2. Dye-reduction Tests

Dye-reduction tests depend upon the ability of bacteria growing in milk to reduce the oxidation-reduction potential to a level at which the colour of the dye is either changed as with resazurin or completely discharged as with methylene blue. Dye tests therefore give a measure of the metabolic activity of the bacteria in milk, and in this way differ fundamentally from counting methods.

The reducing activity of different bacteria varies, but those which actively sour milk are in general active dye-reducers also (Wilson, 1935; Hobbs, 1939). Dye tests may, however, fail to indicate the presence of relatively inert bacteria which may be present in some milk-samples in large numbers. Thus Rowlands & Provan (1941) have shown that dye tests may fail to reveal the presence of thermophilic bacteria which may occur in large numbers in some samples of pasteurized milk, and Malcolm & Leitch (1936) found that during winter raw milk may contain large numbers of bacteria and still give a long reduction-time with methylene blue. It should be emphasized, however, that such types, because of their inert

characteristics, are unlikely to influence the keeping-quality of milk.

For routine control purposes, the dye tests possess certain advantages. They have a small experimental error, require a minimum of equipment, and can be done by relatively unskilled workers. They give as good a measure of the cleanliness or the keeping-quality of milk as any of the other bacteriological tests which are in general use.

Following the adoption of the methylene-blue test for the official examination of Accredited and Tuberculin Tested raw milk in 1937 (Memo. 139/Foods), several workers reported surprisingly good agreement between the placing of a series of samples of designated milk by this test and by the plate-count method previously used (Fairer, 1937; Orwin, 1938; Barkworth *et al.*, 1941).

For the routine examination of fortnightly samples from individual producers under the National Milk Testing and Advisory Scheme, the dye resazurin is used instead of methylene blue (Ministry of Agriculture and Fisheries, 1943). Fundamentally the resazurin and methylene-blue tests are the same. Resazurin, however, is reduced in two stages, from blue through various colour-tints to pink, and finally to white. The time taken to reach the pink stage is shorter than with methylene blue (Johns & Howson, 1940), and the time to reach the white stage slightly longer (Thomas, Thomas & Davies, 1939). A comparator is available to permit an accurate measure—in terms of disk numbers ranging from 6 to 0—of the change in colour of resazurin during reduction in milk (Davis & Thomas, 1940). By observing the disk value reached after a definite time of incubation at 37°C., a result can be obtained without waiting for complete reduction as with methylene blue.

In the routine resazurin test as used under the National Milk Testing and Advisory Scheme, an attempt has been made to compensate for the effect on milk-quality of day-to-day variations in atmospheric temperature. The time of incubation at 37°C. is varied according to the mean of the maximum and minimum temperatures at which the milk is held during the 24-hour period preceding testing. Thus, when the mean temperature<sup>1</sup> is greater than 60°F. the disk readings are recorded at the end of 15 minutes, and when less than 40°F. after 2 hours. This has not, however, succeeded in attaining the object of levelling the proportion of unsatisfactory samples at all seasons of the year. Thomas (1945) found that of 400,000 samples tested under the scheme, the proportion classed as unsatisfactory ranged from 2% when the mean temperature was less than 40°F. to 17% when it exceeded 60°F. and 25% when it exceeded 65°F.

The retention of the methylene-blue test for designated raw milk and the introduction of the resazurin test under the National Milk Testing and Advisory Scheme have led to some confusion in the minds of producers whose milk is tested by both methods. Comparison of the results by the two tests has, however, shown that there is in general good agreement, although individual samples may show wide differences (Egdell & Thomas, 1943; Thomas & Peregrine, 1944).

The time-factor in making a test to determine the suitability for acceptance of milk at the creamery-platform is highly important, and in this respect the 10-minute resazurin test possesses decided advantages for this

purpose (Barkworth, Davis, Egdell, Rowlands & Watson, 1943; Thomas, Phillips & Andrews, 1943; Anderson & Wilson, 1945). In Britain this test is used as a basis of rejection of milk at all creameries with their own laboratories.

With the possible exception of their use for the detection of thermophiles, dye-reduction tests have not, until recently, found much support for the examination of pasteurized milk. Rowlands & Provan (1941) found that dye tests applied to samples of freshly pasteurized milk failed to differentiate between samples with widely differing bacteriological quality, but when samples were aged for 24 hours at 15.5°C. or 18°C. before testing, a better measure of keeping-quality was obtained. Based on these findings, they evolved a modification of the resazurin test to assist in the detection of contamination of pasteurized milk from plant-surfaces during its handling after heat-treatment (Provan & Rowlands, 1943a). Further work by the same authors (Provan & Rowlands, 1943b; Rowlands & Provan, 1944), which involved examination of samples of pasteurized bottled milk taken at fortnightly intervals during a period of 12 months from 27 dairies, showed that a ½-hour methylene-blue or resazurin test, applied to samples which had been stored before testing at 18°C. for 24 hours from the time of removal from the dairy cold-stores for delivery to consumers, provided a good indication of the actual keeping-quality of the milk, as well as a measure of the extent of plant-contamination and the care taken to ensure cool storage before delivery. Tests made on samples stored at atmospheric temperature instead of 18°C.—the procedure now adopted for official tests of heat-treated and pasteurized milk—while indicating keeping-quality in the hands of the consumer, failed to give an adequate measure of plant-contamination during winter, when atmospheric temperature was low. For plant-control purposes therefore, storage of samples at 18°C. or some similar temperature is necessary.

### 3. Presumptive Coliform-Test

Coliform organisms in themselves are not dangerous to human health, but in the examination of water they afford a delicate index of excretal pollution. The same significance must not be attached to their presence in milk, since they may be derived from dung, dust, or unsterile equipment-surfaces at the farm or at the processing dairy. Moreover they multiply rapidly in milk at temperatures of 50°F. or higher. In addition, the errors of estimation by the dilution-methods used are very large (Wilson, 1935). Clearly therefore, results of coliform-tests on milk must be interpreted with extreme caution, especially when tests are made on samples which have been aged at uncontrolled temperatures.

Coliform organisms are, however, undesirable in milk. They contribute to the rapid deterioration of keeping-quality (Barkworth, 1934), and lead to difficulties in the manufacture of dairy-products (Whitehead & Cox, 1932; Hiscox, 1934; Kelly, 1939; Crossley, 1942, 1946).

The coliform-test provides a good measure of the extent of contamination of pasteurized milk from plant-surfaces during cooling and bottling (Vernon & Walker, 1936; Crossley, 1946). A coliform standard has been adopted recently for pasteurized milk in Scotland (Statutory Rules and Orders, 1944c).

<sup>1</sup> [ $^{\circ}\text{F.} = 5/9(t-32)^{\circ}\text{C.} - \text{Eq.}$ ]

#### 4. Keeping-Quality Tests

Keeping-quality may be defined as the time that milk will retain its original sweet flavour. It is the measure by which the consumer judges milk.

A measure of the true keeping-quality is afforded by holding samples at a constant temperature, usually 15.5°C. or 18°C., until the milk becomes tainted or clots when boiled (Ministry of Agriculture and Fisheries, 1934). The determination of the end-point by smell or taste is highly subjective, and an alternative procedure which gives an end-point closely in agreement with smell has been suggested by Anderson & Wilson (1945). This involves withdrawing portions at regular intervals and observing for the presence of clots when an equal volume of milk and 68 % ethyl alcohol are mixed.

Hiscox, Hoy, Lomax & Mattick (1932) found that the time taken to reduce methylene blue in raw milk stored at 15.5°C. agreed closely with the end-point by tasting: similar close agreement has been observed for pasteurized milk (Rowlands & Provan, 1944). This form of the methylene-blue test has been adopted for testing heat-treated milk in Scotland (Statutory Rules and Orders, 1944b).

While the other bacteriological tests that have been discussed afford an indirect measure of keeping-quality, the results are not highly correlated with the true keeping-quality: a value of  $r$  (correlation coefficient) ranging from about 0.6 to 0.8 has been recorded by different workers (Barkworth, Irwin & Mattick, 1941; Thomas, Bowie, Peregrine & Phillips, 1944; Anderson & Wilson, 1945). If, therefore, information concerning keeping-quality is what is required, the only absolute method is to measure keeping-quality, using one or other of the tests that have been mentioned.

#### B. ROLE OF LABORATORY TESTS IN MILK-CONTROL

To secure milk of satisfactory cleanliness and keeping-quality, laboratory tests are required to serve two different functions. They are required to assess the general level of quality of all milk-supplies, which involves frequent and regular testing of milk from all individual suppliers. They are also required to give information which will enable producers and processors to assess, and if necessary to correct, their methods, so as to ensure compliance with statutory standards.

Tests which are to be used for the first purpose should have a small experimental error and, since large numbers of samples are involved, should be simple and inexpensive. These attributes may not be as essential in tests used by the industry itself, or by those whose function it is to advise producers and dairymen rather than to administer statutory regulations. Moreover, tests which may serve for routine milk-grading may not be sufficiently sensitive to give information concerning the exact source of contamination of milk at the farm or at the dairy.

It must be recognized that routine testing will not in itself secure a milk of satisfactory keeping-quality. Testing alone is of little value unless measures are taken to advise producers and dairies experiencing difficulty in complying with prescribed standards and, in cases of persistent

failure, to suspend the distribution of milk from such sources.

Upwards of 160,000 farms are engaged in producing approximately 1,300 million gallons<sup>2</sup> of milk annually in England and Wales at the present time. Except for a short period during early summer, when a small surplus may be available for manufacture, most of the milk is utilized for human consumption in liquid form. In these circumstances, selection of farms—so widely practised for instance in the USA—on the basis of ability to produce a superior-quality milk for liquid consumption is out of the question. Accordingly, a tremendous task is involved in securing an improvement in the bacteriological quality of all milk supplies, bearing in mind the poor facilities that are available on many farms on which we are obliged to depend even to maintain the present inadequate total output.

Milk reaches the consumer through various channels. Of a total liquid-milk consumption in England and Wales of 1,132 million gallons during 1945-6, 16 % was distributed raw by nearly 50,000 producer-retailers (*Home Farmer*, Facts and Figures, 1947). Some milk is distributed raw by dairies supplied direct from farms, or from larger dairies where it is brine-cooled. The remainder, consisting of much the greater part of the total, is supplied by dairies which pasteurize or heat-treat the milk before distribution.

The problems involved in controlling the keeping-quality of milk which is distributed raw, and that which is heat-treated before distribution, differ and will be discussed separately.

#### 5. Control of Milk distributed Raw

So far no official bacteriological standard for raw milk other than that which is sold under the designations Tuberculin Tested or Accredited has been prescribed in Britain. The sooner this defect is remedied the better. A standard for keeping-quality has been prescribed for all heat-treated milk, and it seems reasonable also to demand a standard for milk which is distributed raw.

The testing of producer-retailer supplies by the routine resazurin test under the National Milk Testing and Advisory Scheme has done much to remedy the situation created by the lack of a statutory standard. For producer-retailer supplies, however, this test which is done on milk samples aged for 24 hours at atmospheric temperature may fail to give an assurance of adequate keeping-quality during summer. This applies particularly to milk produced at the evening milking which is delivered to the consumer on the morning following production, and is expected to keep sweet for at least a further 24 hours. In the test (Ministry of Agriculture and Fisheries, 1943), the period of incubation when mean temperatures exceed 60°F. is 15 minutes only, and milk which at 24 hours reduces resazurin in this time is unlikely to remain sweet until completely utilized by the consumer, usually 40-44 hours after its production.

#### 6. Control of Milk which is Heat-treated before Distribution

Heat-treatment of milk is mainly confined to the larger dairies which receive milk from several farms. The first

<sup>2</sup> [1 gallon = 4.54 l.—Ed.]

task facing these dairies is elimination of milk which may be unsuitable for including in the bulk for processing, which involves careful scrutiny of every churn of milk received. A rapid test which could be applied to every churn of milk before it is tipped would be of the greatest advantage, but a satisfactory test for this purpose has not as yet been evolved.

The most rapid bacteriological test available is the 10-minute resazurin test (Ministry of Agriculture and Fisheries, 1942a), which is in operation under the National Milk Testing and Advisory Scheme at all dairies that have their own laboratory facilities. Even this test is too time-consuming to permit testing of every churn of milk. Consequently, dairies must rely largely on the ability of milk-receptionists to detect by appearance and smell milk which is unsatisfactory. Records of regular routine tests made of the milk of individual producers are of value in indicating supplies which are likely to be unsatisfactory.

Raw milk may contain large numbers of thermophilic bacteria which survive pasteurization. Most of these bacteria are inert in milk and will not be detected by any of the dye tests. Their detection involves laboratory pasteurization—145°F. for 35 minutes—of samples from each producer, and plating on milk-agar with incubation of plates, preferably at 30°C. instead of 37°C. (Anderson & Meanwell, 1933).

Fortunately these thermophilic bacteria are of no public-health significance (Hansen, 1932), and have little effect on the keeping-quality of pasteurized milk. Their presence in large numbers in raw milk is an indication of inadequate cleaning and sterilization of milking equipment, especially milking machines, on the farm. Thermophilic bacteria which proliferate rapidly at the temperature of "holder" pasteurization<sup>3</sup> may lead to trouble, especially when hot sections of milk-pasteurization plant are inadequately cleaned and sterilized. Thermophiles are less likely to lead to trouble when milk is pasteurized by the HTST process, as the temperature used—162°F.—is above the optimum for their growth (Hiscox, 1944).

The detection of thermophiles requires special methods: their presence is seldom revealed by plates incubated at 37°C. They may be detected by incubating methylene-blue tubes at 63°C. (Meanwell, 1939), by the Breed microscopical method (American Public Health Association, 1941), or by incubating milk-agar plates at 63°C.

The keeping-quality of pasteurized milk is largely determined by the bacteria which are added to the milk, after heating, from unsterile plant-surfaces during cooling and bottling. Provan & Rowlands (1943a) have shown that dye tests, applied to samples taken at various points during processing and stored for 24 hours at 18°C. before testing, afford a better indication of the source of contamination than the plate-count. Tests of such samples for the presence of coliform organisms are also valuable for this purpose, especially if samples are aged before testing

(Vernon & Walker, 1936) and the results compared with those for samples from the same bulk of milk taken from the "holder".

### C. METHODS OF ASSESSING THE STERILITY OF MILK-EQUIPMENT

Frequent reference has been made to the importance of unsterile equipment-surfaces as sources of bacteria in milk.

The problem of assessment of the cleanliness and sterility of milk-equipment may be approached from two different angles, according to whether a measure is desired of the probable effect of the residual flora on the bacteriological quality of the milk, or of the efficiency of the apparatus and methods. The former object can be achieved by suitable bacteriological tests on samples of the same bulk of milk taken at various stages in production or processing, and results obtained in this way are invaluable for tracing sources of contamination likely to affect the commercial life of the milk. A better assessment of the efficiency of the apparatus and methods used for cleaning and sterilization is possible by estimating the bacteria removed from equipment-surfaces by sterile rinses or by swabbing measured areas of surfaces which are not amenable to rinsing.

Only a proportion of the bacteria on surfaces is removed by rinse- or swab-methods, and careful standardization of procedures used is essential to secure reproducible results. Techniques for rinsing churns (Ministry of Agriculture and Fisheries, 1942b) and for swabbing equipment (Ministry of Agriculture and Fisheries, 1944a) have been issued and are in use extensively for the examination of churns and other equipment in connexion with advisory work under the National Milk Testing and Advisory Scheme. The application of these methods as a basis for advice has been instrumental in bringing about a remarkable improvement in the efficiency of churn-washing at dairies throughout England and Wales.

Special importance must be attached to the assessment of the sterility of milk-bottles. Empty bottles may be returned from houses where there is infectious illness, and their adequate sterilization before refilling at dairies is obviously of the greatest importance. There is considerable agitation in Britain, especially in public-health circles, for a statutory standard for the sterility of milk-bottles. The results of an exhaustive study by Mattick & Hoy (1937) and Hobbs & Wilson (1943) of the problems involved in washing bottles might well form the basis for such a standard. On a basis of the number of bacteria recovered from washed milk-bottles by a rinse-technique, Mattick & Hoy have suggested a standard of not more than 200 and Hobbs & Wilson not more than 600 bacteria per pint bottle [1 pint = 0.568 l.]. With adequate control of the strength and temperature of the detergent in bottle-washing machines, and precautions to avoid recontamination of bottles from subsequent clean-water rinses, there should be no difficulty in attaining either of these standards in practice.

<sup>3</sup> [See article by E. B. Anderson in this number (BMB 1118) for definitions of the "holder" and HTST processes.—Ed.]

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## EVOLUTION OF BACTERIOLOGICAL STANDARDS FOR MILK IN ENGLAND

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- 1 Selection of tests
- 2 Fixing of standards
- 3 Standards for ordinary milk
- 4 Standards for designated milk
- 5 Standardization of technique

The evolution of bacteriological standards in England can best be traced through the Acts and Orders and other control schemes which have been in operation since 1915, in which year measures for the control of milk assumed a modern

outlook and were brought within the scope of a single set of regulations.

Before passing to those measures it is important to note that bacteriological quality is not a single quality, but must be judged from several viewpoints which differ in importance according to the treatment to which the milk is subjected before consumption, and the stage at which the milk is sampled.

### 1. Selection of Tests

If, for example, milk is sampled during delivery to the consumer, the important factors for which tests should be applied are safety and keeping-quality, and the tests and standards for these attributes may be quite different according to whether the milk is raw or pasteurized. Again, if a milk is sampled between the place of production and delivery to the dairy, standards to be set and the appropriate tests to apply would depend on whether that milk was to be pasteurized before consumption or sold to the customer without heat-treatment. If the former, the most appropriate test would be that for "pasteurizability", and freedom from pathogenic organisms, although highly desirable, would be of lesser importance; if the latter, safety and keeping-quality would be the essentials at whatever stage the milk was sampled.

Quite separate and distinct tests are required for the different attributes which combine to make up bacteriological quality, although alternative tests may be available to examine for the same attribute. The selection of tests must be made

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according to the facilities available for testing and after consideration of certain other factors. For example, if a milk-supply is to be tested for "safety", the results of a microscopical examination of the centrifuged deposit followed by inoculation into guinea-pigs will give a fairly complete answer concerning its freedom from pathogenic organisms of bovine origin, but if the milk is pasteurized a more satisfactory test would be the phosphatase-test for efficiency of pasteurization, an alternative which is not available for raw milk. Neither test would provide the complete answer, but either would provide enough information on which to base an opinion. Again, if a sample of milk is to be tested for keeping-quality, a result can be obtained either by keeping the sample and testing at regular intervals until it becomes unpalatable, by testing for plate (colony) count, for methylene-blue reduction-time, for the resazurin-reduction figure, or by alcohol test. By standardizing the conditions under which the samples are taken and the tests are done, standards can be set which, when interpreted in the light of the treatment to which the bulk is normally subjected, will provide a basis for the control of any particular attribute of the milk-supply.

## 2. Fixing of Standards

Before setting such a standard, however, extensive experience is required of the behaviour of the bacterial populations in milk under different conditions of handling and treatment and their influence on the result of the test, and it is as a result of experience in the value of different tests that it has been possible to introduce standards and change them from time to time. Safety and keeping-quality are the two attributes contributing to bacteriological quality for which statutory standards have been set.

This is scarcely the place to enter into a discussion as to the comparative importance of safety or keeping-quality, or even of nutritive value, but a point which is frequently ignored is that, however nutritious a milk may be or whatever tests may have been applied to ensure its safety, the consumer will derive no benefit if the milk becomes unpalatable before it can be used. It is a matter for regret, therefore, that the importance of keeping-quality and cleanliness has at times been forgotten in stressing the importance of safety. The two qualities are supplementary, and to emphasize one to the detriment of the other is a mistaken policy. Safety, as applied to milk, means freedom from organisms capable of causing disease in man, and only one standard is possible. There is, therefore, no question of evolution of standards except in so far as different tests may be introduced, which bring about improved control. An indirect test for pasteurized milk which provides an unerring guide to the efficiency of pasteurization has recently been introduced as a statutory test. It is the phosphatase-test, and in so far as it provides information concerning pasteurizing efficiency, it goes a long way towards guaranteeing the safety of the milk, provided the milk has not been exposed to pathogenic contamination after heating.

The keeping-quality of milk, as the term implies, is the period which elapses between the time of production and the development of unpalatability. So long as the onset of unpalatability does not occur before the milk has been consumed or before the consumer has received the next delivery, the keeping-quality may be regarded as satisfactory.

## 3. Standards for Ordinary Milk

*Milk & Dairies (Consolidation) Act 1915* and *Milk & Dairies (Amendment) Act 1922* Modern legislation for the control and improvement of the milk-supply was initiated by the Milk and Dairies (Consolidation) and (Amendment) Acts. These gave the President of the Local Government Board, later the Minister of Health, power to make orders which were intended to set out in detail the steps to be taken by the dairy industry and by the controlling authorities to ensure that the desired improvement would take place.

*Milk & Dairies Order 1926* In pursuance of these powers the Milk and Dairies Order was made in 1926. This order aimed at improving the conditions under which milk was produced, handled and distributed, by setting minimum requirements for buildings used as cowsheds and dairies, by specifying the methods to be used for washing utensils and equipment, and generally laying down rules for the avoidance of contamination of milk at all stages between the cow and the consumer.

Neither of the Acts nor the Order mentions a bacteriological standard, and it is clear that there was no intention of setting such a standard. The obvious intention was to create conditions of handling which, if observed, would inevitably lead to improvement without the imposition of a bacteriological standard.

It is probable, however, that if in 1926 an attempt had been made to set a bacteriological standard with which all milk had to comply it would have been impossible to operate for several reasons. In the first place, milk-testing laboratories and staff did not exist in sufficient numbers; secondly, milk-testing methods were laborious and could not have been applied with the necessary frequency and in the numbers which would certainly be necessary to ensure adequate control; thirdly, most producers had not the necessary equipment or knowledge, and were incapable of complying with any bacteriological standard which could be regarded as reasonable. These reasons against the setting of a bacteriological standard no longer obtain today and, as will be shown later, a bacteriological (resazurin) standard for all milk has been in operation since June 1942. An account of the history of the development of the testing, advisory and educational services which led up to the present position would be too long to include within the scope of a single article, but it is sufficient to say that the provision of laboratories, the training of staffs and the application of suitable tests for control on a national scale, have been made possible by the Advisory Dairy Bacteriological Service of the Ministry of Agriculture, with the encouragement and co-operation of the National Institute for Research in Dairying. The education of producers has been achieved by means of clean-milk competitions and advisory schemes organized by the County Agricultural Education Staffs, and operated by them in conjunction with the Advisory Dairy Bacteriologists.

During this time the larger dairies were installing laboratories to an increasing extent and by means of bonus schemes were taking advantage of the county educational and advisory schemes. Unfortunately, selective buying on basis of tests tended to divert the better supplies into the larger dairies, and the poorer supplies were left to the smaller dairies without facilities for laboratory control. Some small dairies without these facilities imposed as one

condition of purchase that the producer must participate in a county clean-milk competition or advisory scheme. Many dairies paid the entry-fees, but the main point is that during the period between the wars all branches of the industry worked together in promoting improvement in the bacteriological quality of milk. By 1939 most producers, either directly or indirectly, had benefited from the educational and advisory facilities provided by national funds, and while it is true that no national bacteriological standard had been set for ordinary milk, experience had been obtained in the use of tests and in methods of milk-control, and the quality had improved to such an extent that the time was almost ripe for the setting of a national standard; all that was required was the impulse.

On the outbreak of war in 1939, quantity became the keynote of production. Milk-producers became pre-occupied with the need for increased quantities of home-grown foods both for stock and for human consumption, and this, together with the shortage of labour, inevitably brought about a rapid deterioration in milk-quality. Milk was being lost through souring in increasing quantities, and this provided the impulse for the introduction of the National Milk Testing and Advisory Scheme by the Ministry of Agriculture and Fisheries in co-operation with the Ministries of Food and Health. The resazurin test was used, a uniform technique of testing was established, and national standards introduced for the first time with which all milk had to comply.

It must be stressed that this was an advisory scheme without statutory powers. It introduced three grades of milk called Category A, Category B, and Category C, which were equivalent to good, moderate, and poor keeping-qualities. Producers whose milk fell into Category C were advised and helped to improve it; those who refused to improve were warned, given every chance, and finally, with the assistance of the Milk Marketing Board, were refused permission to supply milk for human consumption. The scheme has operated with the assistance and collaboration of all branches of the industry which is anxious that, whatever final form the wartime scheme may take, the national standards shall be retained.

#### 4. Standards for Designated Milk

So far, the evolution of standards has been described only in regard to ordinary milk, but the powers granted to the Minister of Health by the Acts of 1915 and 1922 included the power to make orders for the introduction of designated milks and for controlling the conditions under which these special milks would be produced and sold.

*Milk (Special Designations) Order 1922* Following the operation of schemes of an experimental nature, and in pursuance of the powers just mentioned, the Milk (Special Designations) Order was made in 1922 and introduced three grades of raw milk and one of heat-treated milk.

*Ministry of Health Circular 356; 1922* Bacteriological standards were introduced which were believed to be

"such as to provide milk that is superior to ordinary milk . . . and at the same time bring the production and distribution of the milk within the competence of all careful dairymen".

Thus it was felt that standards could be set with which at least a limited number of producers and dairymen could comply.

TABLE I. MILK (SPECIAL DESIGNATIONS) ORDER 1922

Designation	Bacteriological standards		Other conditions
	Plate (colony) count (per ml.)	<i>B. coli</i> absent in	
Certified milk ...	30,000	0.1 ml.	(1) Produced from tubercle-free cows (2) Bottled at the place of production (3) Must not be treated by heat
Grade A (Tuberculin Tested) milk	200,000	0.01 ml.	(1) Produced from tubercle-free cows (2) Must not be treated by heat
Grade A milk ...	200,000	0.01 ml.	Produced from veterinary-supervised herds
Pasteurized milk (until 1/1/1924) (after 1/1/1924)	50,000	No standard	Heated to 145° F.—150° F. [63° C.—66° C.] for at least 30 minutes; cooled to 55° F. [13° C.]
	30,000	0.1 ml.	

These bacteriological standards were set for samples taken before delivery to the consumer, transported immediately to the laboratory and tested on arrival, and were thus intended to give the bacteriological condition of the milk at the time of sampling. It is clear that, since the place of sampling might be at any point between the farm and the consumer's door, the 24-hour period which might easily elapse between these points caused the standard to vary considerably according to the age of the milk at the point of sampling. The influence of time and temperature on the bacteriological condition of the milk was therefore not sufficiently appreciated, nor was the need for absolute uniformity in the methods of testing, as no detailed instructions were issued to serve as a guide in carrying out the test.

*Milk Special Designations (Amendment) Order 1922* An Amendment Order was made in December 1922, introducing certain alterations which the brief period of operation of the original order had shown to be necessary. These mainly affected pasteurized milk and in this connection permitted the use until 1 July 1923, of "any process of pasteurization (including the flash process) capable of effecting the necessary reduction of bacteria".

No alteration was made in the bacteriological standard.

*Milk (Special Designations) Order 1923* On 25 May 1923, a second Milk (Special Designations) Order was made which again altered the standards for pasteurized milk as from 1 July 1923, so that in the brief period of a year three Special Designations Orders were necessary, each introducing changes in one or other of the standards which experience had shown to be impracticable.

TABLE II. PASTEURIZED MILK

Order	Date	Bacteriological standards		Other conditions
		Plate (colony) count (per ml.)	<i>B. coli</i> absent in	
Milk (Special Designations) Order 1922	before 1/1/24	50,000	No standard	Heated to 145°F.—150°F. for at least 30 minutes; cooled to 55°F.
	after 1/1/24	30,000	0.1 ml.	
Milk (Special Designations) Amendment Order 1922	before 1/7/23	unchanged	unchanged	Any process of pasteurization (including the flash process) capable of effecting the necessary reduction of bacteria
Milk (Special Designations) Order 1923	before 1/1/24	200,000	No standard	(1) After 1/7/23 heated to 145°F.—150°F. for at least 30 minutes; cooled to 55°F.  (2) Must not be so heated more than once
	after 1/1/24	100,000	No standard	
	Grade A milk (pasteurized)			
	before 1/1/24	50,000	0.01 ml.	
	after 1/1/24	30,000	0.1 ml.	

## 5. Standardization of Technique

*Memorandum 139/Foods 1929, Ministry of Health* A notable advance was made in 1929 when the Ministry of Health imposed a standard technique for the sampling and testing of graded milk. Much work had been done in the interval, particularly by the Advisory Dairy Bacteriologists, which demonstrated the magnitude of the error likely to occur if the methods employed in the sampling and testing of milk varied, and the introduction of a standardized technique must therefore be regarded as a definite step in the evolution of bacteriological standards. Dairy bacteriologists had previously standardized their testing-techniques in 1924.

For a further period of 13 years no change in bacteriological standards took place, but during this time there was intensive research with a view to improving technique and investigating the value of the statutory and other tests for use in milk grading.

In 1935, the Medical Research Council<sup>1</sup> published a valuable and comprehensive survey of all the tests then known which were likely to be of value for milk-grading.

*Milk (Special Designations) Order 1936* The result of this work appeared to show that a methylene-blue standard would overcome some of the disadvantages inherent in the combined plate-count and coliform standard for raw milk which had been current until that time, and in 1936 a third Special

Designations Order was made which changed the nomenclature of the grades and introduced a methylene-blue standard for raw milk. The standards for pasteurized milk were this time left unchanged.

This order, which came into limited operation on 1 June 1936, and full operation on 1 January 1937, reduced the number of grade-designations, and in doing so made a single grade of Tuberculin Tested milk, thus eliminating the separate standard of 30,000 bacteria per cm.<sup>3</sup> for milk bottled on the farm. Thus from June to December 1936, only one count-standard—200,000 per ml. with no coliform organisms in 0.01 ml. existed, and from 1 January 1937, the methylene-blue standard was introduced.

It is of considerable interest to note that in the new order permission was granted to pasteurize Tuberculin Tested milk while permission to pasteurize Accredited milk, the equivalent of the original Grade A milk, was withheld.

*Memorandum 139/Foods January 1937, Ministry of Health* The methylene-blue standards now set involved a period of ageing, equivalent to half a day, at atmospheric

temperature before the test was begun, although the count-standards which still operated for the two types of pasteurized milk required the immediate transportation of the samples to the laboratory, or, if the period of transit was likely to be prolonged, immediate packing in ice until the test was begun.

It is of interest to note that a period of ageing at atmospheric temperature before testing was specified in 1924 for all samples tested by Advisory Dairy Bacteriologists in connexion with the Clean Milk Competitions and Advisory Schemes.

*Circular 1533—1936 Ministry of Health* Another point to note, which is not a change of standard but which implies a change of attitude towards a standard, is that the

TABLE III. MILK (SPECIAL DESIGNATIONS) ORDER 1936

Designations		Bacteriological standards		Other conditions
1923	1936	Methylene-blue reduction-time (hours)	Coliform organisms absent in	
Certified milk	Tuberculin Tested milk (Certified)	Winter 5½	0.01 ml.	Produced from tubercle-free cows
Grade A Tuberculin Tested milk	Tuberculin Tested milk			
Grade A milk	Accredited milk	Summer 4½		Produced from veterinary-supervised cows
Grade A milk (pasteurized)	None	Plate(colony) count per ml.		
		—	—	—
None	Tuberculin Tested milk (pasteurized)	30,000	No standard	Heated to 145°F.—150°F. for at least 30 minutes; cooled to 55°F.
Pasteurized milk	Pasteurized milk	100,000	No standard	Must not be so heated more than once

<sup>1</sup> Wilson, G. S., Twigg, R. S., Wright, R. C., Hendry, C. B., Cowell, M. P. & Maier, I. (1935) *Spec. Rep. Ser. med. Res. Coun., Lond.* No. 206

coliform test was required to be done only occasionally, although of many thousand samples tested in the writer's laboratory since 1936 none has been submitted for the methylene-blue test only.

For assisting in the control of pasteurized milk, this circular suggests that licensing authorities will find the phosphatase-test of value, but no standard was set with which the milk was required to comply for statutory purposes.

*Milk (Special Designations) Regulations 1941* On 9 July 1941, regulations were made permitting the use of an alternative method of pasteurization which sanctioned milk which had been heated to not less than 162°F. [72.7°C.] for at least 15 seconds, provided that the apparatus was suitable and fitted with an automatic device to divert the flow of milk not adequately heated. No change in the bacteriological standards was made.

*Milk (Special Designations) Regulations 1946* Finally, in 1946 the standards for pasteurized milk were again changed, the count-standard being finally discarded and a methylene-blue standard of  $\frac{1}{2}$ -hour introduced together with a phosphatase-standard. The method of ageing and testing was carefully standardized, but unfortunately the specified method of ageing makes compliance with the conditions almost impossible during spells of hot summer weather. Early amendment of these conditions is essential.

*Statutory Rules & Orders 1944 No. 65* Reference to standards for pasteurized milk would be incomplete without some mention of Heat Treated milk, which was introduced as a designation by the Ministry of Food in 1944. By a regulation, now generally referred to as "55 G", the type of milk sold in certain areas was restricted in such a way as to ensure that none could reach the public unless it complied with specific bacteriological standards. Tuberculin Tested milk and pasteurized milk could be sold without restriction provided that the conditions of the licences were observed. Accredited milk could be sold only if derived from, and therefore immediately traceable to, a single herd; other milk could be sold only after heat-treatment by authorized dairymen in such a manner as would ensure its compliance with prescribed methylene-blue and phosphatase-tests.

This completes the account of the changes which have occurred up to the present time—changes which have involved the introduction of new tests and the alteration of standards as and when these appeared to be necessary or desirable. None of the standards has been high, but

TABLE IV. STATUTORY STANDARDS FOR DESIGNATED MILK

Methylene-blue reduction-time (hours)	Period & temperature of ageing	Designation
Winter $5\frac{1}{2}$	$\frac{1}{2}$ -day at atmospheric temperature	Tuberculin Tested milk (certified)
Summer $4\frac{1}{2}$		Tuberculin Tested milk Accredited milk
$\frac{1}{2}$	Until between 9 & 10 a.m. on the day after sampling at atmospheric temperature not exceeding 65° F. [18.3° C.]	Tuberculin Tested milk (pasteurized) Pasteurized milk Heat-treated milk

TABLE V. ADVISORY STANDARDS FOR RAW MILK

Resazurin disc-numbers	Period & temperature of ageing	Category
4 to 6	1 day at atmospheric shade-temperature	A
1 to $3\frac{1}{2}$		B
0 and $\frac{1}{2}$		C

of recent years they have been such that compliance with them was possible for the average producer or dairyman without extravagant outlay on buildings, plant or labour.

For statutory purposes, the methylene-blue reduction-test is the basis of the bacteriological standards for designated milk both raw and heated. In addition, grades of raw milk must have no coliform organism in 0.01 ml., and heated milk must give a reading not greater than 2.3 Lovibond blue units for the phosphatase-test.

For routine advisory purposes, the resazurin test is used and has come to be generally accepted.

After some twenty years' experience of bacteriological testing of milk for both Statutory and Advisory purposes, of interpreting the results of tests and advising in cases of failure to comply with the standards, it is the writer's opinion that, whatever test is used and whatever standard is set, greater benefit is likely to accrue if standards are also set for buildings, equipment and methods. The maximum benefit is possible only if the three services concerned—bacteriological, advisory, and administrative—work closely in touch with each other.

# CHEMICAL STANDARDS AND ANALYTICAL METHODS FOR MILK

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There is no legal definition of milk, and the word "quality" in respect of milk is used very loosely and sometime includes both chemical composition and bacteriological quality. These two properties are quite independent and unrelated one to the other.

The fact that milk contains fairly large proportions of fat, protein, sugar and salts has been known for a long time, but it was not until reasonably-accurate analytical methods, suitable for routine use, were devised, that any general knowledge was obtained of the way in which the chemical composition of milk varied. From a general point of view, the chemical constituents of milk are conveniently divided into two parts: fat, and the solids-not-fat. The fat includes also the lipoids, such as lecithin, and the fat-soluble vitamins A and D. The solids-not-fat fraction contains everything else—casein, albumin, globulin, lactose, mineral salts and the water-soluble vitamins B<sub>1</sub>, B<sub>2</sub>, and C.

For some time previous to about 1900, the commonly-used analytical methods for milk consisted of a total-solids determination by evaporation, and the measurement of specific gravity by a special hydrometer (usually referred to as a lactometer). The usefulness of the latter is derived from the fact that, whereas the fatty portion of milk has a specific gravity of about 0.9, the solids-not-fat have a specific gravity considerably in excess of 1.0. The specific gravity of milk is therefore lowered by increasing fat-content and raised by increasing solids-not-fat. By the use of suitable formulae it is possible, knowing the total solids (i.e. fat plus solids-not-fat), to estimate the fat and solids-not-fat separately from a knowledge of the specific gravity of the milk.

## Introduction of Direct Fat-Estimation Methods

However, the gravimetric determination of total solids is not a suitable procedure for the routine examination of large numbers of samples, and it is also costly, since it requires a good balance. Various attempts were made to devise a simple routine method for the direct estimation of fat and, in the last decade of the 19th century, the Babcock and Gerber methods were introduced for this purpose. They consist essentially of treating the milk with strong acids which disrupt the protein membrane round the fat-globule and so allow the fat to form a continuous phase at the surface of the liquid, separation being accelerated and completed by centrifuging. The Babcock method is

in almost universal use in North America, and the Gerber test is practically universal in Britain.

The development of these direct fat-estimating methods removed the necessity for the gravimetric method, and virtually the whole of the British milk supply is now controlled by the Gerber method, and the solids-not-fat tests are made by the lactometer method. The milk of some 165,000 British dairy-farmers is tested, usually once or twice a month, by these tests, and in addition bulk supplies are likewise tested.

## Seasonal and other Natural Variations

The evolution of these simply analytical methods also resulted in giving the authorities fairly precise information about the composition of different sorts of milks at different times of the year and the effect of various factors on the composition of milk. This led to the ultimate adoption of chemical standards for milk. These were based upon the consideration of a large number of analyses made in all parts of the country at different times, and the presumptive standards adopted were 3.0 % for fat and 8.5 % for solids-not-fat.

TABLE I. EFFECT OF BREED OF COW ON MILK SOLIDS

Breed	Fat (%)	Solids-not-fat (%)	Protein (%)	Lactose (%)	Ash (%)
Jersey ...	5.14	9.59	3.80	5.04	0.75
Guernsey ...	4.98	9.57	3.84	4.98	0.75
Ayrshire ...	3.85	9.05	3.34	5.02	0.69
Shorthorn ...	3.63	8.94	3.32	4.89	0.73
Friesian ...	3.45	8.48	3.15	4.65	0.68

The fat is by far the more variable factor, being easily influenced by such factors as breed of cow, yield, the time of the year, stage of lactation, etc. The content of solids-not-fat is much more constant and, although influenced to some extent by the same factors that control fat, varies between much narrower limits. For this reason it was possible to make for the solids-not-fat a chemical standard much closer to the average value than in the case of the fat. The latter varies from about 3.4 % or lower in May, when the yield of milk is at its highest and the fat-content at its lowest, up to about 3.9 % or even higher in December. The standard of 3.0 % was adopted on the argument that no milk produced from an ordinary herd in Britain would under normal conditions ever fall below 3.0 % in fat-content. Similarly the value for solids-not-fat normally varies from about 8.6 % to 8.9 %.

TABLE II. FACTORS AFFECTING FAT-CONTENT

Increase	Decrease
Good management	Feeding cod-liver oil
Short milking-interval	Long milking-interval
Complete milking-out	Incomplete milking-out
Young cows	Old cows
Later stage of lactation	Flush of milk (2nd to 5th months)
Cold weather	Warm weather
Moderate exercise	Rest
	Abnormal conditions, excitement, etc.
	Inexpert milkers

(Other factors are the individuality of the cow and breed.)



TABLE III. FACTORS AFFECTING CONTENT OF SOLIDS-NOT-FAT

Increase	Decrease
Young cows	Mastitis (disease of udder)
Later stage of lactation	Old cows
Spring pasture	Flush of milk (2nd to 5th month)
	Indoor feeding

(Broadly speaking, the fat-content of milk is more variable than the content of solids-not-fat, which is fairly constant.)

The effect of various factors on the fat and solids-not-fat content of milk is illustrated in tables I, II, III and IV. Different sets of figures give slightly different results for breed-values, but all show quite clearly that Jersey and Guernsey milks are the richest and Friesian is the poorest. There has been a slight fall in the average solids-not-fat content of Britain's milk over the past 20 or 30 years. Although the exact reasons are not known, it is probable that the increase in the number of Friesian cattle has been a major factor.

TABLE IV. SUMMARY OF ACCURATE (REFERENCE) AND SIMPLE ROUTINE TESTS FOR MILK

Constituent	Accurate tests	Routine tests
Fat ...	Röse-Gottlieb ... Adams ... (ether-extraction)	Gerber Babcock (acid-centrifugal separation)
Solids-not-fat...	Gravimetric ... (evaporation of moisture & correction for fat)	Lactometer (specific gravity & correction for fat)
Added water...	Freezing-point ...	Lactometer & conductivity-measurements
Lactose ...	Polarimetric ...	Polarimetric
Protein (total)	Total nitrogen (Kjeldahl)	Sørensen titration (with formalin)
Casein ...	Precipitation at pH 4.6 & weighing	Precipitation at pH 4.6, redissolving & Sørensen titration
Salt (NaCl) ...	Silver titration after digestion with HNO <sub>3</sub>	Conductivity
Ash ...	Heating to dull-red heat	—
Visible dirt ...	Official Society of Public Analysts method (centrifugal)	Filter-pad or "sediment tester"

(Normally only fat and solids-not-fat tests are made on milks.)

#### Detection of Adulteration with Water

In early years, there was little control of the quality of milk, and the sale of milk was in the hands of a large number

of small vendors, some of whom were not too scrupulous, and the proportion of adulterated milk was undoubtedly high. There was available no specific test to detect the addition of water to milk, and the authorities therefore had to adopt the basis that if milk fell below the presumptive standards of 3.0 % fat or 8.5 % solids-not-fat it should be presumed to be watered unless the contrary was shown. This worked very well in practice, since the milk-seller could always resort to the "appeal to the cow" test. This meant that, if accused of watering his milk because of its low content of solids, he could "appeal to the cow", or have samples taken from the milk as produced from his herd. If the tests on milk as taken agreed with those of his milk as sold to the public, then it was obvious that his milk was genuinely deficient in fat or solids-not-fat, and had not been adulterated.

#### Differentiation of Adulterated and Pathological Milk

In the course of time it became recognized that the solids-not-fat could have a low value from a pathological cause not previously suspected—mastitis. This disease is an inflammation of the udder caused by certain streptococci and other organisms which often results in the secretion of milk low in solids-not-fat. Such milk, usually called "abnormal milk" or "mastitis milk", often has a solids-not-fat content of less than 8.5 %, and until scientific knowledge extended and a more accurate test for added water became available, such milk was often suspected.

The solution to this problem came when the development of the freezing-point test gave public analysts a method for the more certain detection of added water in milk. This test depends upon the fact that genuine milk has a freezing-point which usually lies between  $-0.540$  and  $-0.550^{\circ}\text{C}$ . In a small proportion of samples from individual cows the freezing-point may be as low as  $-0.560^{\circ}$  or sometimes as high as  $-0.530^{\circ}\text{C}$ .

Following upon this discovery there has been a general agreement amongst dairy-chemists and public analysts that if milk has a freezing-point higher than  $-0.530^{\circ}\text{C}$ , then it can certainly be assumed that the milk contains added water. The adoption of this as the standard gives a tolerance-equivalent to about 3 % water, since the average freezing-point depression is about  $0.544^{\circ}\text{C}$ . It is, therefore, customary nowadays for milks to be tested first by the fat and solids-not-fat test and then, if either is suspiciously low, for a freezing-point test to be made. The freezing-point test is not yet a statutory test, but it is now often accepted in a court of law as supporting evidence for or against the allegation that the watering of milk has taken place.

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## MODERN METHODS OF HANDLING AND DISTRIBUTING MILK

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- 1 Production
- 2 The collecting creamery
- 3 Transport
- 4 Processing or pasteurization
- 5 Bottling
- 6 Care in the home
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Modern methods of handling this important food are concerned with the object of delivering to the consumer a physically-clean, bacteriologically-safe product with the nutritive value impaired, if at all, to the minimum extent possible.

### 1. Production

As the conditions of production on the farm have an important effect on the efficiency of the subsequent handling, the review of events must start here. The principles governing the production of a clean safe milk are simple and have long been known, but it is only in comparatively recent times that their importance has been fully appreciated.

In properly-managed herds the cows, the only animals of importance for the production of milk in Britain, are free from disease, *i.e.*, *M. tuberculosis* and *Br. abortus*, and clean, *i.e.*, free from extraneous dirt, particularly on the teats, udder and flanks. The milker and those associated with the dairy, besides being clean in person, are free from communicable diseases such as septic sore-throat, or organisms of the typhoid and paratyphoid group. The utensils used are cleaned and then sterilized by treatment with steam or boiling water. This proviso applies particularly to the most modern types, such as the small top-pail and the milking-machine, both of which are advantageous if correctly cleaned and sterilized, but if not the results may be worse than those obtained by the old method of hand-milking. Although milk produced under the satisfactory conditions outlined above will keep for considerable periods without cooling or refrigeration, this is necessary if there is delay in utilization, particularly when the atmospheric temperature

is high.<sup>1</sup> Although much milk is still cooled by standing the cans in cold water, it is now more customary to pass the milk over a corrugated-surface refrigerator which may be cooled by water or, in the more advanced types, by means of a direct-expansion refrigeration-unit. Whatever the method, it is usual to cool to at least 60°F., lower if possible.<sup>2</sup> The milk is poured into cans, generally nowadays of 10-gallons capacity<sup>3</sup>, provided with mushroom-shaped lids which prevent the access of any foreign matter, whether liquid or solid. These are a great advance on the old type with drop-in lids.

It is now the practice for the creamery to provide the cans, which have been washed with hot water, scalded with steam, and dried with hot air in mechanical washers capable of handling up to 300 cans per hour. Rapid transport of the cans between creamery and farm and vice-versa is accomplished by motor lorry, thus widening the area from which supplies may be collected.

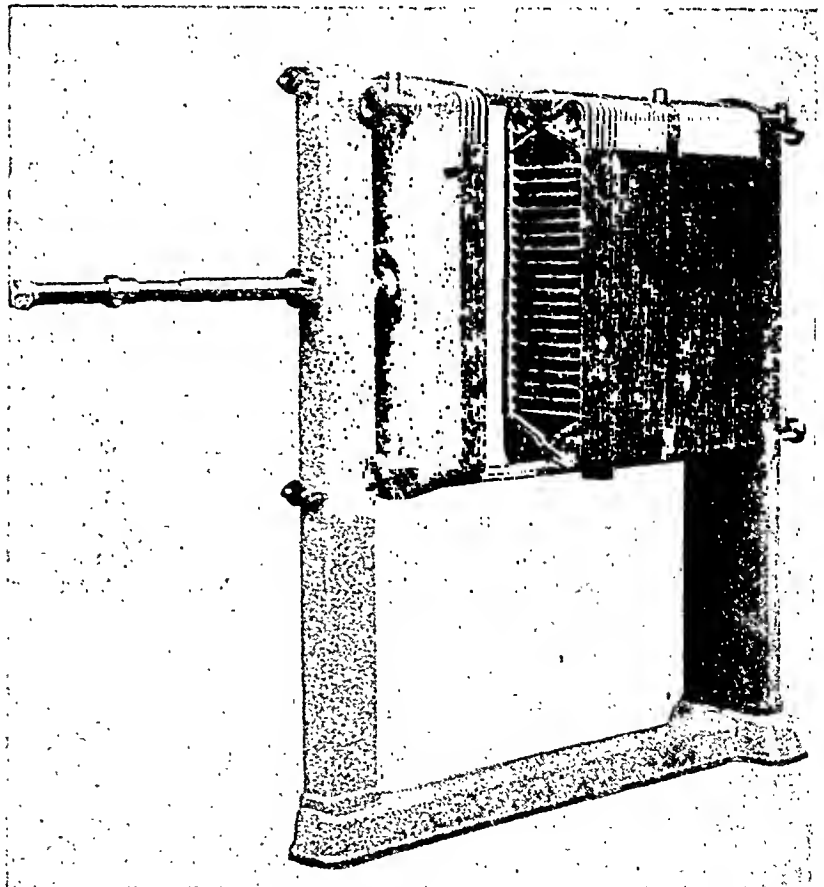
In this section, the main advance has been the greater appreciation and application of hygienic methods in production, and on the mechanical side the introduction of the mechanical instead of the manual washing of the cans.

<sup>1</sup> [See article by A. Rowlands in this number (BMB 1115.—Ed.)

<sup>2</sup> [1°F. = 5/9(1-32)°C.—Ed.]

<sup>3</sup> [1 gallon = 4.54 l.—Ed.]

FIG. 1. PLATE-TYPE COOLER



The milk is pumped through the cooler, where it is cooled first by water and then by refrigerated brine to a temperature of 38–40°F. [3.3–4.4°C.]

## 2. The Collecting Creamery

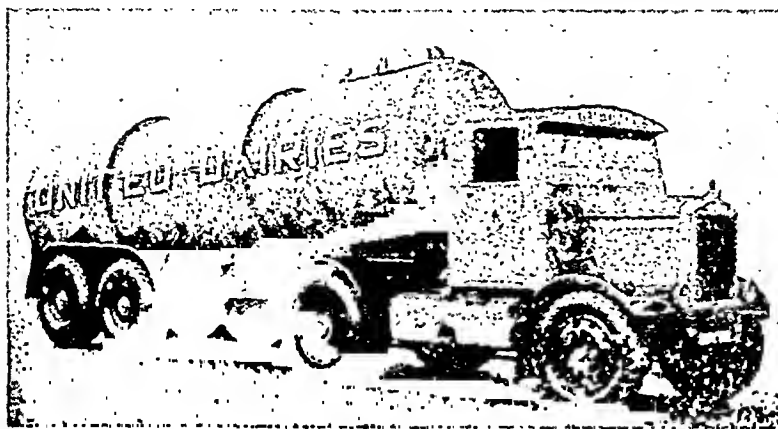
Although creameries have long existed in milk-producing areas, their function has changed; at one time concerned mainly with limited local sales and the manufacture of cream, butter and cheese, they have now become specialized links in the chain of distribution to the urban communities which, before their increase in size, received the milk direct from the producer by rail transport in cans usually of 17-gallons capacity, in which period considerable losses occurred through souring in unfavourable weather. Nowadays, on receipt at the local creamery, each can of milk is examined by inspectors who have been trained to detect by odour any milk which exhibits signs of deterioration or other abnormality. Such milk, together with that of other producers who may be suspected of not providing the grade required, is subjected to a dye-reduction test in the control laboratory which for this purpose operates the National Milk Testing and Advisory

rail transport (fig. 2, 3). The insulation is usually of cork or an expanded-rubber product protected by an outer metal sheath. A man-hole is provided for access, and a suitable air-vent and cock for withdrawal of the contents. The fittings are reduced to a minimum to allow of easy cleaning, which is accomplished by rinsing with cold water, washing with a detergent delivered in the most modern method by a high-pressure jet; finally sterilization is effected by blowing in live steam for about 15 minutes. Sometimes, for the last stage, a solution of sodium hypochlorite containing 200 parts per million of available chlorine is used, but steam is to be preferred. In such tanks, the contents can be transported considerable distances in hot weather with only a small rise in temperature. This refrigeration at the creameries and transport in bulk is the major revolution which has taken place since the 1914-18 war.

Milk is a biological fluid of high nutritive value for bacteria, whether harmful or harmless, and therefore, in order to avoid the transmission of pathogenic organisms, and to increase the keeping-quality, in all enlightened British cities and towns the raw product is now subjected to some form of heat-treatment, usually that known officially as pasteurization. This secures the freedom from pathogenic organisms which is of vital importance to the health of dense communities, and avoids economic loss from souring, particularly where household refrigerator-storage is not available, a common fault in Britain.

On arrival at the processing-depot, the milk is discharged from the transport-tanks, either by gravity or compressed air, into intermediate-storage tanks of glass-enamelled steel, stainless steel, or aluminium. If there is likely to be a delay in subjecting the milk to the heat-treatment, the temperature is again reduced to 40°F. by passage through a plate-cooler as, at this temperature or below, there is no multiplication of those bacteria which cause deterioration.

FIG. 2. INSULATED MILK-TANK FOR TRANSPORT BY ROAD



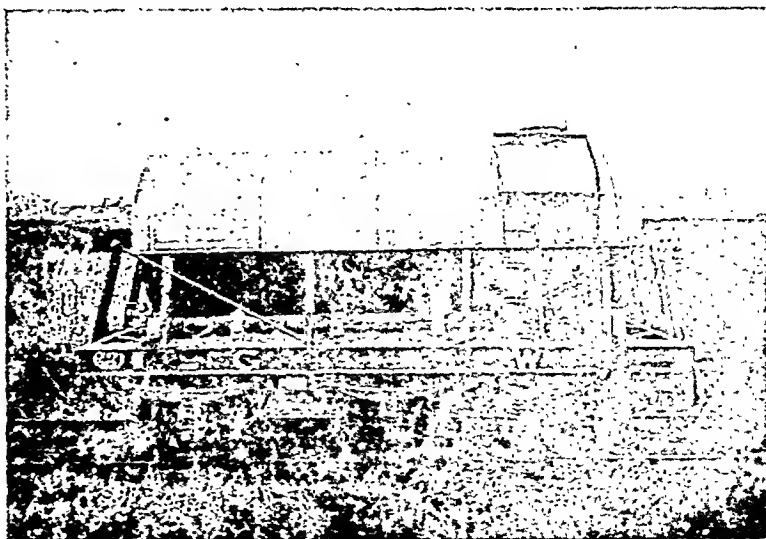
The milk passes directly from the cooler into the tank, which is of glass-enamelled or stainless steel and of 1,000-3,000-gallons capacity. The insulation is usually of cork or rubber

Scheme of the Ministry of Agriculture. This test is a rough indication of the numbers and activity of the organisms in the milk, and thus provides an objective test of its suitability for consumption. Milk which does not pass is returned to the producer. Consignments which are of a satisfactory nature are tipped into a tank of about 50-gallons capacity, the weight of the milk in which is indicated on a dial. From here it is pumped through a plate-type cooler (fig. 1), in which it is cooled first by water and then by refrigerated brine to a temperature of 38-40°F. All plant through which milk is passed is previously thoroughly cleaned, followed by sterilization with steam or hot water at about 180°F.

## 3. Transport

From the cooler, the milk passes directly to insulated tanks of glass-enamelled or stainless steel of 1,000-3,000-gallons capacity, mounted on chassis suitable for road or

FIG. 3. INSULATED MILK-TANK FOR TRANSPORT BY RAIL



#### 4. Processing or Pasteurization

There are two methods of pasteurization officially recognized—the “holder” and the High-Temperature: Short-Time (HTST). The regulation covering the former is that “the milk shall be held at a temperature of not less than 145°F. and not more than 150°F. for at least ½ hr.”, and the latter that “the milk shall be retained at a temperature of not less than 162°F. for at least 15 seconds”.

These conditions are based on the minimum time required to destroy the most resistant pathogenic organism, viz. *M. tuberculosis*, with an ample margin of safety.

On its way to either type of pasteurizing plant, the milk is pumped either cold or warm through centrifugal cleaners or cloth filters to remove any extraneous matter which may have gained access either at the farm or subsequently. It is then raised to the required temperature by passage through a plate-type regenerative heater in which the hot milk coming from the plant serves to heat the incoming milk, itself being cooled in the process. The final heating to the required temperature is accomplished by means of circulating hot water in a similar plate-type heater.

In the “holder” or “batch” process, the milk thus raised to 145°F. passes to the holding-vessels, which may have a capacity of from 100–1,000 gallons. The holding-time is automatically controlled in such a way that the discharge-valve is opened after the required period has elapsed. Recorders registering the temperature and time of holding are fitted to all such plants.

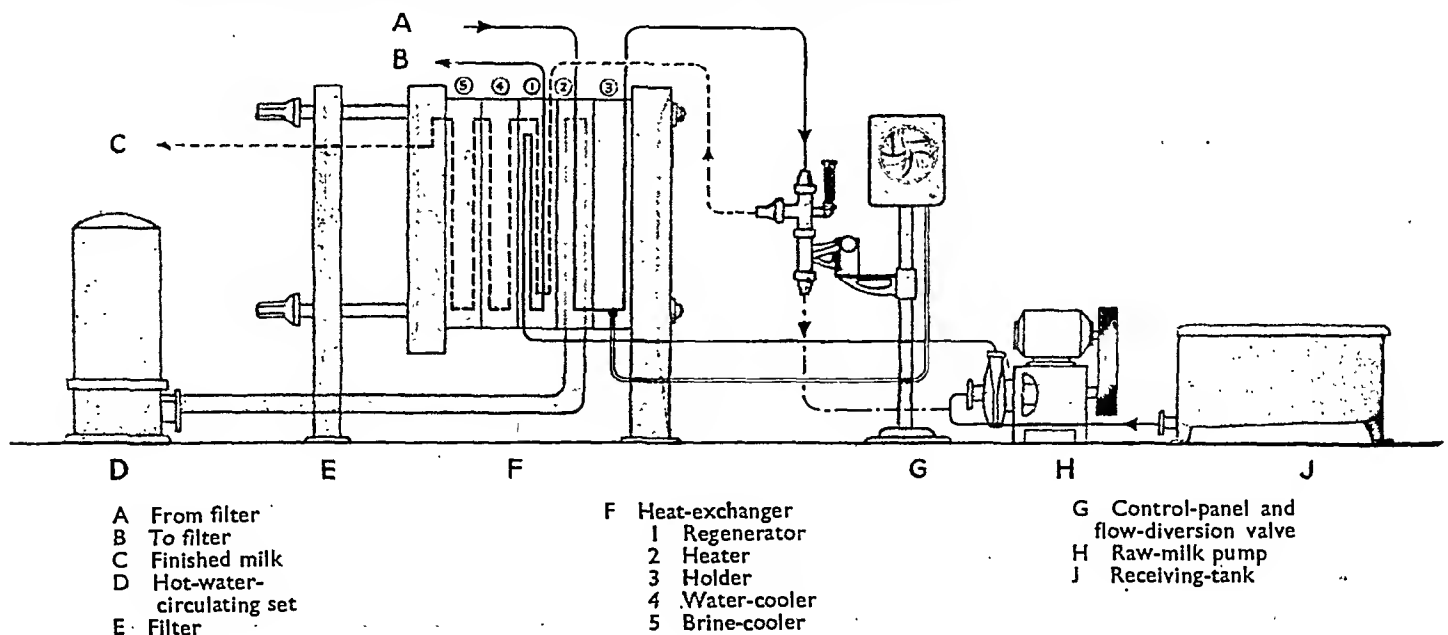
The HTST process requires more complicated plant and more delicate control, but has the advantages that it takes up much less space and is continuous in operation. Plants capable of processing 2,000 gallons per hour are now in existence. The raw milk is pumped to the regenerative heater through a constant-flow device. This is an essential part of the plant because, with the very short holding-time of 15 seconds, any variation in flow would involve considerable inaccuracy. The milk then passes to the holding-section, which is an enlarged plate, placed at the end of the heating-section of the plate-heater, and of such capacity that the

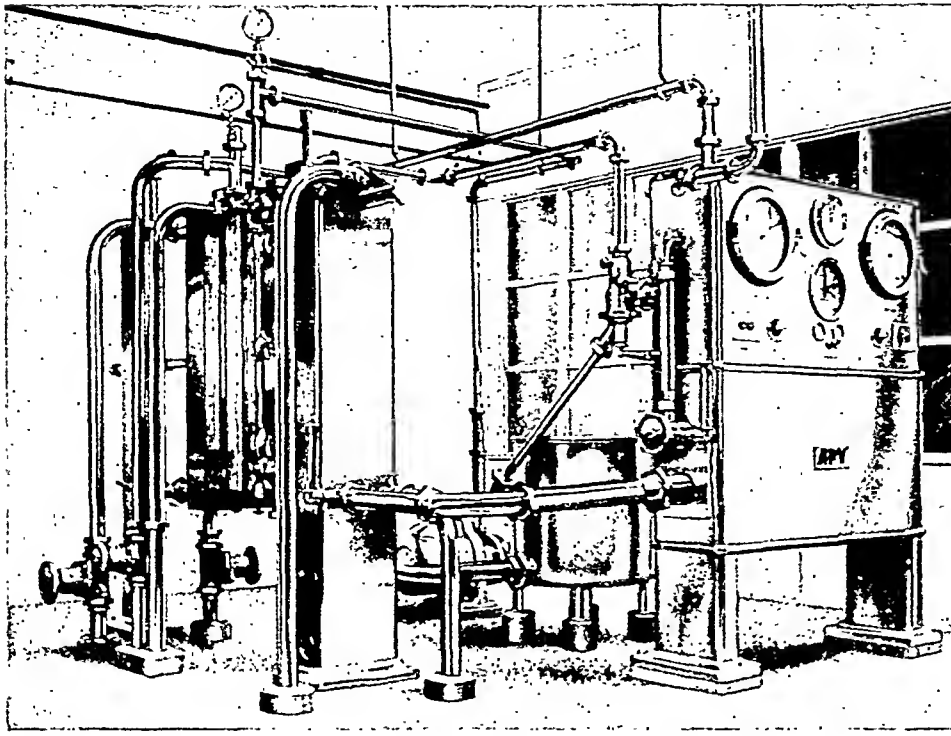
milk passes through it in not less than 15 seconds. The exit-pipe from this holding-section is fitted with a flow-diversion valve actuated by a solenoid or by compressed air, either of which is brought into operation by a system depending on a mercury or vapour-in-steel thermometer fitted into the exit-pipe. The effect of this device is to cause the milk to be diverted back to the raw-milk tank if its temperature falls below that set for operation. At the same time a warning-bell or light signals the position to the operator. When the correct temperature is regained, the diversion-valve is re-set either automatically or by hand. With this mechanism it is impossible for any underheated milk to pass forward. Recently, thermo-electric couples have been suggested instead of the thermometers referred to, the claim made being that the unavoidable lag between the fall in temperature of the milk and the operation of the control-mechanism is much reduced, thereby allowing the process to be conducted much nearer the permissible minimum temperature of 162°F., with less reduction in the volume of cream forming on the cold milk. This system, however, is still in its infancy, and it is at present the usual practice to operate at a temperature 1°F. above the legal minimum and for about half a second longer.

The usual recording-instruments are provided to give on the chart a permanent record of the temperature during operation.

By whatever process the milk is pasteurized, it is immediately cooled to 40°F. by means of the incoming cold milk referred to above, followed by cold water and finally refrigerator-brine. It is quite usual for the whole of the heating and cooling systems to be combined in one unit. Fig. 4 is the flow-diagram of such a complete unit of an HTST plant including the holder. Fig. 5 is an illustration of the plant itself. On the left is the combined heating, pasteurizing and cooling unit, in which is also incorporated the filter. On the right is seen the cabinet housing the controlling and recording instruments, and just to the left of this the flow-diversion valve. Fig. 6 shows the construction of the plates, between pairs of which the milk passes with the heating or cooling medium on each side.

FIG. 4. FLOW-DIAGRAM OF A COMBINED HEATING AND COOLING UNIT OF AN HTST PLANT





**FIG. 5.**  
HTST HEAT-TREATMENT  
PLANT EMBODYING  
A COMBINED HEATING  
AND COOLING UNIT  
(left)

A flow-diagram of this plant is shown in fig. 4.

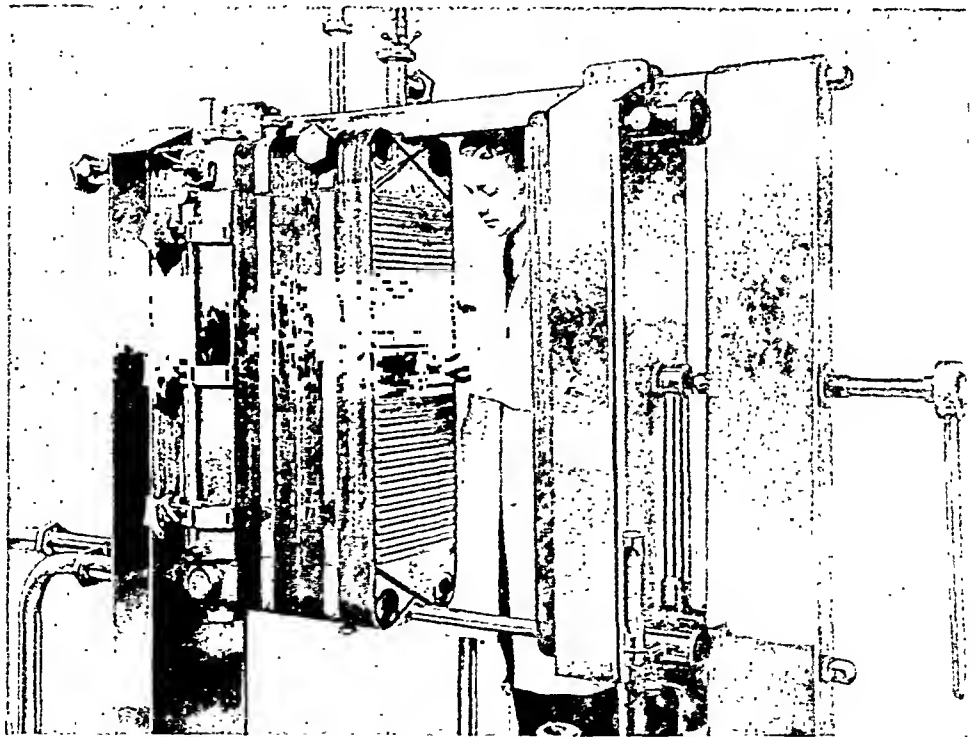
For further description, see text

**FIG. 6.**  
PLATES OF THE HEATING  
AND COOLING UNIT  
OF AN HTST PLANT

The milk passes between pairs of the plates, with the heating or cooling medium on each side



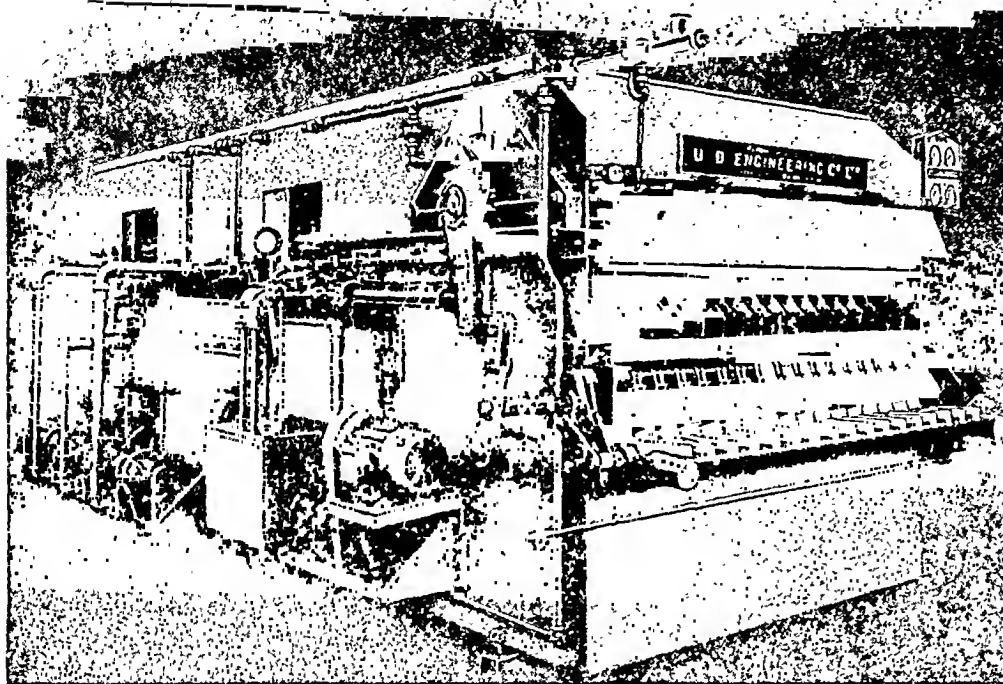
Accurate as are the controls and recording instruments on modern plants, there was until recent years no satisfactory test which could be applied to the milk itself to confirm that the processing had been satisfactorily achieved. This most desirable goal was achieved when Kay & Graham (1935) published what is known as the phosphatase test in a form suitable for plant-control. This test depends on the fact that milk contains an enzyme, a phosphomonoesterase capable of hydrolyzing organic phosphates under certain defined conditions. By great good fortune this enzyme is destroyed under the time-temperature combination used for pasteurization. Briefly, the milk is incubated with a buffered solution of disodium phenyl-phosphate, and if the enzyme is absent no phenol is set free by hydrolysis. But if, because of under-treatment or contamination with raw milk, enzyme is present, phenol is set free and its quantity is estimated colorimetrically by a suitable reagent. The test is so sensitive that the presence of 0.25% raw milk, or a deficit of 1.5°F. below the required minimum temperature of 145°F. in the holder process, can be detected. Out of the thousands of tests made, in no



instance has the presence of *M. tuberculosis* been detected by animal inoculation in milk which has passed the test.

Mention should be made of the in-bottle process, in which the whole operation of heating and cooling is carried out in the bottle, but there is insufficient independent evidence on which to base a considered judgement.





**FIG. 7.**  
**MECHANICAL**  
**BOTTLE-WASHING**  
**PLANT**  
(left)

The bottles are rinsed, treated with hot caustic-soda solution, and rinsed again with clean water at descending temperatures. Up to 160 bottles per minute can be treated in units of the type illustrated

**FIG. 8.**  
**AUTOMATIC COMBINED**  
**FILLER AND CAPPER OF**  
**MILK-BOTTLES**

### 5. Bottling

The cold milk passes before bottling to storage-tanks, where it is kept in gentle agitation to prevent separation of cream, from whence it passes to the bottling-machines. The bottles, either new or as received back from the consumer, are washed and sterilized in mechanically-operated washers capable of handling up to 160 bottles per minute (fig. 7).

They first receive a rinse with tepid water to remove residues of milk or any loose material which may have gained access. They are then treated externally and internally with hot caustic-soda solution, either by complete immersion in the solution or spraying from jets under pressure, or a combination of both. The objects of this treatment are to dissolve any material not previously removed by the water-rinse, and to effect sterilization, as for the latter purpose steam cannot be applied for the requisite time where large numbers of bottles have to be treated. The combination of time, temperature, and concentration of caustic soda necessary to attain this object is illustrated

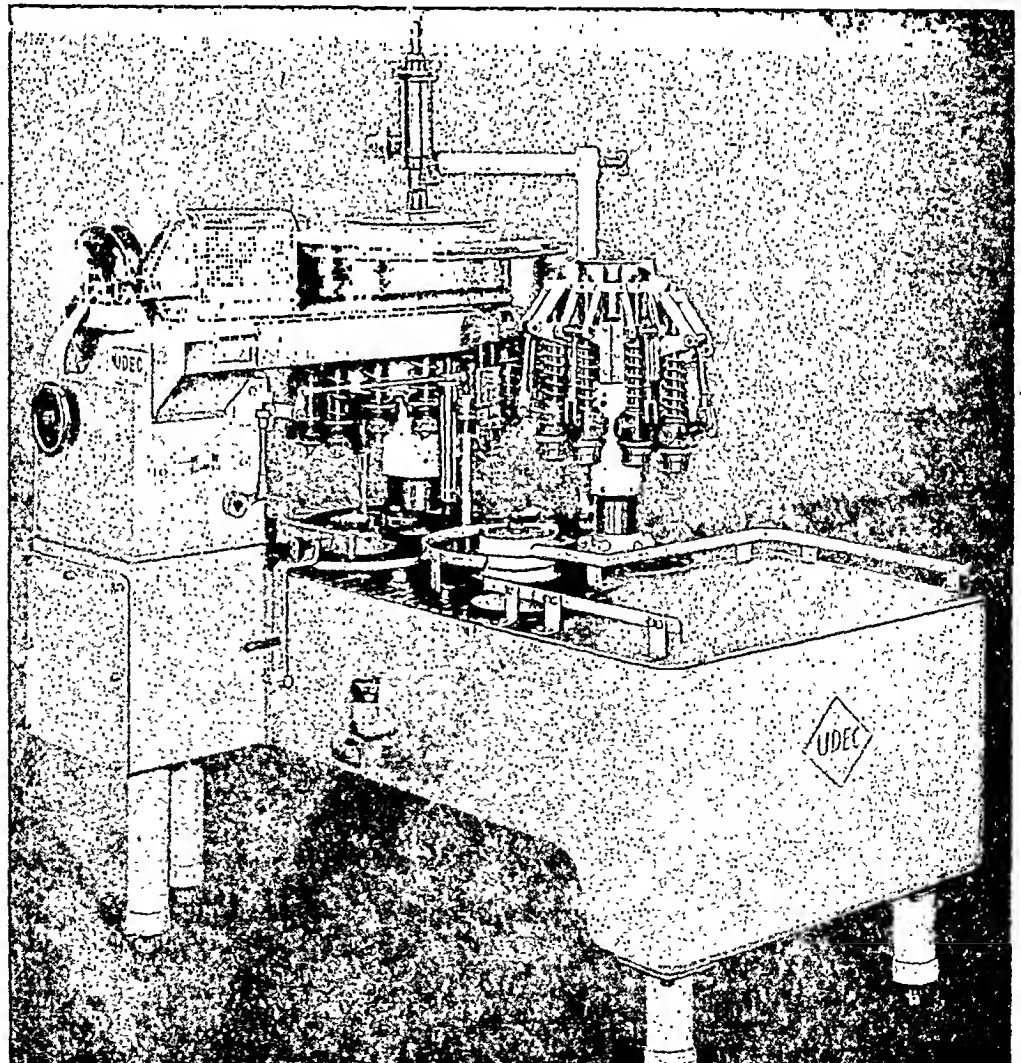
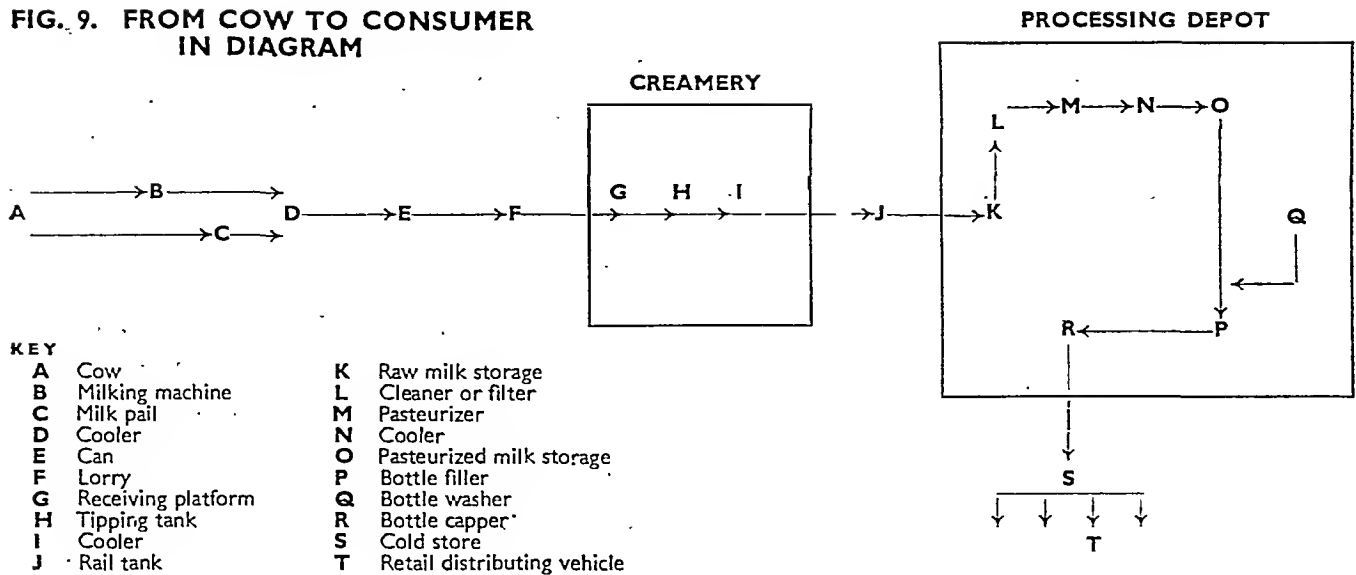


FIG. 9. FROM COW TO CONSUMER  
IN DIAGRAM

in the table given by Hobbs & Wilson (1943). In practice, temperatures of 140-150°F. are usual, and concentrations of caustic soda at least double (i.e. 2-3%) those given by Hobbs & Wilson in order to provide an ample margin of safety. The caustic-soda treatment is followed by rinsing with clean water at decreasing temperatures to remove the caustic solution and cool the bottles so that they emerge at about 60°F. or less. In order to obtain free rinsing, it is usual at some stage to incorporate an alkali phosphate, such as trisodium phosphate or sodium hexametaphosphate, or one of the newer organic wetting-agents.

At the discharge-end, the bottles are visually inspected and any containing foreign material such as cement, bottle-caps, etc., which cannot be dealt with by the caustic soda, are removed. It is possible that in the near future this inspection may become automatic.

From the washing-machine the bottles immediately pass along covered conveyors to the completely automatic bottling-machines capable of filling up to 4,800 bottles per hour with the cold milk from the storage tanks. Adjacent to each bottling machine is a capping machine which inserts a waxed cardboard disc in the mouth, or clinches on an aluminium cap which has been cut from a strip as the bottle passes to the capping-head. Fig. 8 shows such a completely automatic combined filler and capper. The advantage of the aluminium cap is that the pouring-lip is protected from any contamination during the handling which is unavoidable between this stage and delivery to the customer—the first occasion on which there is again a possibility of contamination in the long journey from the cow to the home.

The filled bottles are packed into clean crates which are immediately transported to cold-stores, whence the milk goes out on the rounds for delivery to the customer's doorstep.

#### 6. Care in the Home

As all consumers cannot be supplied with safe milk of good keeping-quality, which results from the procedure described, it is desirable to refer here to the procedure to be adopted where the size of the community does not allow of the economic distribution of pasteurized milk, and where, therefore, raw milk has to be consumed. Where available, TT

(Tuberculin Tested) milk should be used, as this is reasonably safe, but where it is not, or where young children are concerned, all raw milk should be brought just to the boil before use, and after transfer to a clean vessel cooled by standing in cold water, the mouth of the container should be covered with a loose metal or net cap to prevent access by flies, etc.

All milk should be kept as cool as possible at all times, preferably in a refrigerator. Where larders are unsuitably situated and refrigerators non-existent, covering the bottles with one of the porous-clay covers filled with water made for this purpose is a very useful method, or alternatively, keeping the bottles in an outside meat-safe fixed to a north wall. The mouth of the bottles should always be kept covered when not in use, to prevent attention by cats and other vermin. Milk should not be exposed to sunlight as, apart from the heat-effect, this causes rapid destruction of the vitamin C, and, at certain seasons of the year, the development of an objectionable flavour in the cream referred to usually as 'cardboard,' 'powdery,' etc.

When empty, the bottle should be rinsed out with cold, not hot water, as residues of milk left in bottles standing on doorsteps and similar places attract flies, snails and other undesirable visitors, and make the eventual cleaning far more difficult than it should be.

Finally, milk-bottles should never be used as containers for paraffin, disinfectants or similar materials.

\* \* \* \*

To sum up, the outstanding developments during the last 25 years have been:—

- i. Application of the principles of hygiene on the dairy farms, and increased attention to the health of the animals.
- ii. Refrigeration and bulk-transport.
- iii. Pasteurization or equivalent heat-treatment of the milk supplied to the larger communities.
- iv. Reduction of contact with the human hand to a minimum by increased mechanization and the use of bottles.
- v. Improved methods and a higher standard of cleaning and sterilization of creamery and processing plants.

*Continued at foot of page 214*

# LACTATION AND ITS PRODUCTS

## A Bibliography of British Books and Journals

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The literature in which our knowledge of milk and its products is recorded is both large and scattered. Information of a scientific sort is commonly recorded first in a periodical. It is true that in Britain we have a few periodicals devoted entirely to dairying, but we have many more which from time to time publish articles dealing with milk among more numerous articles dealing with other subjects. Books tend to be more specialized, but even at this stage considerable scattering persists. This scattering of information results in difficulty in knowing where to seek needed facts; this in turn results in ignorance from unwillingness or inability to find them. Every argument on pasteurization of milk demonstrates these results.

Medical men are much concerned with lactation in the human and with utilization of milk by the human. In our civilization, most of the milk used by mankind is obtained from the domesticated animals. The production, processing, distribution and control of the very large quantities of perishable food involved constitute one of our greatest industries. The belief that this farming, processing and distributing industry is not well understood by consumers and their medical advisers is the excuse for the inclusion in this bibliography of so many periodicals and books outside the normal range of interest of medical men. It is hoped that sufficient information is given to open, for those who so desire, the gate to a wide and cultivated field.

## A. PERIODICALS

*The data given are name of the publication, frequency of appearance, place of publication, name of publisher, amount of annual subscription.*

### 1. Specialized journals in the field of dairying and dairy science.

*The dairy farmer.* Monthly. Ipswich: Dairy Farmer. Eight shillings. [£0.4]

News, opinion and discussion for the milk producer.

*Dairy industries, incorporating ice cream manufacture and dairy technology.* Monthly. London: Dairy Industries. Twenty shillings. [£1]

This journal circulates widely in the milk-processing and dairy manufacturing industry: it publishes short papers describing investigations in applied dairy-science, articles furthering the application of scientific knowledge in the industry, and news.

*The dairyman.* Monthly. London: Dairyman. Ten shillings and sixpence. [£0.525]

News, opinion and discussion for the milk-distributor.

*Dairy science abstracts.* Quarterly. Shinfield, Reading: Imperial Bureau of Dairy Science. Twenty-five shillings. [£1.25]

The Imperial Bureau of Dairy Science attempts in this journal to abstract all current research on milk and milk-products. The field includes dairy husbandry, technology, legal control, economics, physiology of lactation, nutritive value of milk and its products, bacteriology and mycology, chemistry and physics. The journal is linked with *Animal Breeding Abstracts*, *Herbage Abstracts*, *Nutrition Abstracts and Reviews* and *The Veterinary Bulletin*.

*The journal of dairy research.* Irregular. London: Cambridge University Press. Twenty-five shillings [£1.25] (per volume of three issues).

Essentially a journal for the publication of original research from the British Commonwealth, but each issue includes a valuable and authoritative review of the progress of dairy-science. Formerly the journal appeared three times yearly, and sections of the subject were reviewed each two years.

*The journal of the Society of Dairy Technology.* Quarterly. London: Society of Dairy Technology.

A new journal. The first issue appeared in October 1947. It is essentially the proceedings of the Society and contains a selection of papers read and discussions thereon.

*The milk industry. A progressive journal devoted to the production and distribution of milk.* Monthly. London: National Dairymen's Association. Ten shillings. [£0.5]

Essentially a news journal for distributors of liquid milk.

### 2. Agricultural journals containing useful information in the field of dairying.

*Agricultural progress. The journal of the Agricultural Education Association.* Twice yearly. Shrewsbury: Wilding & Son. Five shillings. [£0.25]

Papers read before the Dairying Section of the Agricultural Education Association are published; they are intended to be of interest to agricultural advisers and teachers.

*Agricultural statistics, Ministry of Agriculture and Fisheries. Part I. Acreage and production of crops, number of live stock and of agricultural workers, and output and prices of agricultural produce in England and Wales. Part II. An analysis of agricultural production, prices and supplies in England and Wales.* Twice yearly. London: His Majesty's Stationery Office. Price variable.

The latest issue, Part I of the volume dealing with 1939, appeared in 1941. Official statistics concerning milk-production.

*Agriculture. The journal of the Ministry of Agriculture.* Monthly. London: His Majesty's Stationery Office. Eight shillings. [£0.4]

Mildly informative articles for the farmer.

*Animal breeding abstracts.* Quarterly. Edinburgh: Imperial Bureau of Animal Breeding and Genetics. Twenty-five shillings. [£1.25]

Abstracts covering the field of animal breeding and animal production as related to breeding or heredity.

Continued from page 213

## HANDLING AND DISTRIBUTION OF MILK

vi. Increase in the size of the units operating, with consequent reduction in the costs of operation.

## ACKNOWLEDGEMENTS

The photographs accompanying this article are reproduced by permission of the following firms: Aluminium Plant & Vessel Co. Ltd.; Mickleover Transport Ltd.; U.D. Engineering Co. Ltd.

vii. The introduction of stainless steel for the fabrication of plants wherever possible.

viii. The extension of laboratory control.

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Kay, H. D. & Graham, W. R. (1935) *J. Dairy Res.* 6, 191

*The Ayrshire Cattle Society's journal.* Quarterly. Ayr: Ayrshire Cattle Herd Book Society.

*British agricultural bulletin.* Quarterly. London: British Council. Ten shillings. [£0.5]

This is a new journal. The first issue is due to appear in November 1947. It will publish review articles on recent advances in British agricultural science and practice.

*The British Friesian journal.* Monthly. London: British Friesian Cattle Society. Six shillings. [£0.3]

*British Goat Society monthly journal.* Monthly. Diss: British Goat Society. Twelve shillings. [£0.6]

*The British Goat Society's yearbook.* Annual. Diss: British Goat Society. Three shillings. [£0.15]

*The empire journal of experimental agriculture.* Quarterly. London: Oxford University Press. Twenty shillings. [£1]  
Original research.

*The farm economist.* Irregular. Oxford: Agricultural Economics Research Institute. One shilling. [£0.05]

Brief reports of investigational work. Bibliography of agricultural economics.

*Farm economics. Miscellaneous notes on the economics of farming in Scotland.* Twice yearly. Edinburgh: His Majesty's Stationery Office.

*Farmer and stock-breeder.* Weekly. London: Farmer and Stock-Breeder. Twenty-six shillings. [£1.3]

News, opinion and discussion for the farmer.

*The farmers weekly.* Weekly. London: Hulton Press. Twenty-eight shillings and twopence. [£1.4]

News, opinion and discussion for the farmer.

*Goats.* Monthly. Colchester: Trinity Printing Works. Seven shillings. [£0.35]

*Guernsey breeders' journal.* Quarterly. London: English Guernsey Cattle Society. Eight shillings. [£0.4]

*Herbage abstracts.* Quarterly. Aberystwyth: Imperial Bureau of Pastures and Field Crops. Twenty-five shillings. [£1.25]

Abstracts covering pastures and forage crops.

*The home farmer. The journal of the Milk Marketing Board.* Monthly. Thames Ditton: Milk Marketing Board.

*The Jersey cow. Official journal of the English Jersey Cattle Society.* Quarterly. London: English Jersey Cattle Society.

*The journal of agricultural science.* Quarterly. London: Cambridge University Press. Thirty shillings. [£1.5]

Original research.

*Journal of the British Dairy Farmers' Association.* Irregular. London: British Dairy Farmers' Association.

*Journal, Department of Agriculture, Eire.* Twice yearly. Dublin: Stationery Office. Three shillings. [£0.15]

*Journal of the Farmers' Club.* Irregular. London: Farmers' Club.

Addresses on topical subjects delivered to the Club, with discussion thereon.

*The journal of the Red Poll breed. The official organ of the Red Poll Cattle Society of Great Britain and Ireland.* Three times yearly. Ipswich: Red Poll Cattle Society of Great Britain and Ireland.

*Journal of the Royal Agricultural Society of England.* Annual. London: Murray. Five shillings. [£0.25]

Contains a review each year of dairy-farming and dairy-work.

*The Maux journal of agriculture.* Quarterly. Douglas: Board of Agriculture and Fisheries. Four shillings. [£0.2]

*Monthly report, Ministry of Agriculture, Government of Northern Ireland.* Monthly. Belfast: His Majesty's Stationery Office.

*Proceedings of the Society for Applied Bacteriology (formerly Society of Agricultural Bacteriologists).* Twice yearly. (No

permanent address): Society for Applied Bacteriology.

Many short papers on dairy-bacteriology appear in this journal. The journal has changed its name with the name of the Society; further it formerly described itself as *Abstracts*. Before 1946 it appeared annually.

*Scottish agriculture. The journal of the Department of Agriculture for Scotland.* Quarterly. Edinburgh: His Majesty's Stationery Office. Four shillings. [£0.2]

*The Scottish farmer and farming world and household.* Weekly. Glasgow: Scottish Agricultural Publishing Co. Twenty shillings. [£1.0]

News, opinion and discussion for the farmer.

*The Shorthorn journal. Incorporating the Dairy Shorthorn journal.* Monthly. London: Shorthorn Society of the United Kingdom of Great Britain and Ireland. Six shillings. [£0.3]

*Transactions of the Highland and Agricultural Society of Scotland.* Annual. Edinburgh: Blackwood. Five shillings. [£0.25]

*The Welsh journal of agriculture. The journal of the Welsh Agricultural Education Conference.* Annual. Cardiff: University of Wales Press Board. Two shillings and sixpence. [£0.125]

Original investigations into Welsh agriculture.

### 3. Veterinary journals containing useful information in the field of dairying.

*Index veterinarius.* Twice yearly. Weybridge: Imperial Bureau of Animal Health. One hundred shillings. [£5.0]  
A classified list of references to current publications of veterinary science.

*The journal of comparative pathology and therapeutics.* Quarterly. Croydon: Grubb. Thirty shillings. [£1.5]  
Original work.

*The veterinary bulletin.* Monthly. Weybridge: Imperial Bureau of Animal Health. Forty shillings. [£2.0]  
Abstracts in the field of animal health.

*The veterinary journal.* Monthly. London: Baillière, Tindall and Cox. Thirty shillings. [£1.5]  
Original work.

*Veterinary record.* Weekly. London: National Veterinary Medical Association of Great Britain and Ireland. Seventy-eight shillings. [£3.9]

Original investigations; news and opinion for members of the Association.

### 4. Medical journals containing material concerning milk and lactation.

*Archives of disease in childhood (incorporating the British journal of children's diseases).* Quarterly. London: British Medical Association. Twenty-five shillings. [£1.25]

*The British journal of dermatology and syphilis.* Six times yearly. London: Lewis. Forty-two shillings. [£2.1]  
Reports of cheese-mite itch.

*The British journal of experimental pathology.* Six times yearly. London: Lewis. Forty shillings. [£2.0]

*The British journal of tuberculosis and diseases of the chest.* Quarterly. London: Baillière, Tindall and Cox. Fifteen shillings. [£0.75]

*British medical bulletin.* Irregular. London: British Council. Twenty shillings. [£1.0]

*The British medical journal. The journal of the British Medical Association.* Weekly. London: British Medical Association. Sixty-seven shillings. [£3.35]

Original investigations; news and discussion for members of the Association.

*Bulletin of hygiene.* Monthly. London: Bureau of Hygiene and Tropical Diseases. Thirty shillings. [£1.5]

An abstracting journal with an occasional article reviewing some aspect of hygiene; covers the public-health aspect of milk.

*The bulletin of the Institute of Medical Laboratory Technology.* Six times yearly. London: Institute of Medical Laboratory Technology. Fifteen shillings. [£0.75]

Publishes an occasional minor article on laboratory technique concerned with milk.

*Edinburgh medical journal.* Monthly. Edinburgh: Oliver and Boyd. Forty shillings. [£2.0]

*The Glasgow medical journal.* Monthly. Glasgow: Royal Medico-Chirurgical Society of Glasgow. Forty shillings. [£2.0]

*The Irish journal of medical science.* Monthly. Dublin: Cahill. Twenty shillings. [£1.0]

*The journal of hygiene.* Irregular. London: Cambridge University Press. Seventy-five shillings [£3.75] (per volume of six issues).

Publishes original work on dairy bacteriology and public-health aspects of milk.

*The journal of pathology and bacteriology. The official journal of the Pathological Society of Great Britain and Ireland.* Quarterly. Edinburgh: Oliver and Boyd. Sixty shillings. [£3.0]

*Journal of the Royal Army Medical Corps.* Monthly. London: Staples. Thirty shillings. [£1.5]

*The journal of the Royal Institute of Public Health and Hygiene.* Monthly. London: Gerrans. Twenty-four shillings. [£1.2]

*Journal of the Royal Sanitary Institute.* Quarterly. London: Royal Sanitary Institute. Fifteen shillings. [£0.75]

*The journal of tropical medicine and hygiene.* Six times yearly. London: Bale Medical Publications. Fifteen shillings. [£0.75]

*The lancet. A journal of British and foreign medicine, surgery, obstetrics, physiology, pathology, pharmacology, public health, and news.* Weekly. London: Lancet. Forty-two shillings. [£2.1]

*The medical officer. A journal for medical men in the government and municipal services.* Weekly. London: Hodgetts. Fifty-two shillings and sixpence. [£2.625]

*Monthly bulletin of the Ministry of Health and the Public Health Laboratory Service.* Monthly. London: Ministry of Health.

From time to time publishes articles dealing with milk and public health, including accounts of epidemics spread by milk and dairy-products.

*Proceedings of the Royal Society of Medicine.* Monthly. London: Longmans, Green. One hundred and five shillings. [£5.25]

*Public health. The journal of the Society of Medical Officers of Health.* Monthly. London: Society of Medical Officers of Health. Thirty-one shillings and sixpence. [£1.575]

*Quarterly journal of experimental physiology and cognate medical sciences.* Irregular. London: Griffin. Forty-two shillings (per volume). [£2.1]

Original researches.

*Transactions of the Ophthalmological Society of the United Kingdom.* Annual. London: Ophthalmological Society of the United Kingdom. Forty shillings. [£2.0]

Galactose cataract.

*Transactions of the Royal Society of Tropical Medicine and Hygiene.* Six times yearly. London: Royal Society of Tropical Medicine and Hygiene. Thirty-five shillings. [£1.75]

*Tubercle.* Monthly. London: Bale Medical Publications. Thirty-five shillings. [£1.75]

## 5. Journals of fundamental and applied science in which dairy science is published.

*The analyst. The journal of the Society of Public Analysts and other Analytical Chemists.* Monthly. Cambridge: Heffer and Sons. Thirty-five shillings. [£1.75]

Original investigations and abstracts in the field of chemical analysis and microbiological assay.

*Annual reports of the Society of Chemical Industry on the progress of applied chemistry.* Annual. London: Society of Chemical Industry. Eleven shillings and sixpence. [£0.575]

*Annual reports on the progress of chemistry.* Annual. London: Chemical Society. Fifteen shillings. [£0.75]

*The biochemical journal.* Irregular. London: Cambridge University Press. Seventy shillings. [£3.5]

Original research, including work on the biochemistry of milk, milk-secretion, and the nutritive value of milk.

*Biological reviews of the Cambridge Philosophical Society.* Quarterly. London: Cambridge University Press. Forty-two shillings. [£2.1]

*British abstracts. AI. General, physical, and inorganic chemistry.* Monthly. Fifty-five shillings. [£2.75]

*AII. Organic chemistry.* Monthly. Fifty-five shillings. [£2.75]

*AIII. Physiology, biochemistry, anatomy.* Monthly. Eighty shillings. [£4.0]

*BI. Chemical engineering and industrial inorganic chemistry, including metallurgy.* Monthly. Fifty-five shillings. [£2.75]

*BII. Industrial organic chemistry.* Monthly. Fifty-five shillings. [£2.75]

*BIII. Agriculture, foods, sanitation.* Monthly. Thirty-five shillings. [£1.75]

*C. Analysis and apparatus.* Six times yearly. Fifteen shillings. [£0.75]. London: Bureau of Abstracts.

*The British food journal and hygienic review.* Monthly. London: British Food Journal. Eighteen shillings and sixpence. [£0.925]

A trade journal for the food-processing industry.

*The British journal of nutrition.* Quarterly. London: Cambridge University Press. Sixty shillings. [£3.0]

This is a new journal. The first issue appeared in September 1947. It contains original work in nutrition and the proceedings of the Nutrition Society.

*Chemistry and industry.* Weekly. London: Society of Chemical Industry. Fifty-five shillings. [£2.75]

*Food. Processing-packing-marketing, with which is incorporated the canning and food trade journal.* Monthly. London: Nema Press. Twelve shillings. [£0.6]

*Food manufacture, incorporating food industries weekly.* Monthly. London: Leonard Hill. Twenty shillings. [£1.0]

*Index to the literature of food investigation.* Quarterly. London: His Majesty's Stationery Office. Eighteen shillings. [£0.9]

Annotated references to, and abstracts of, scientific publications concerning processing, manufacture, storage, etc., of food.

*The industrial chemist and chemical manufacturer.* Monthly. London: St. Margaret's Technical Press. Twelve shillings. [£0.6]

*Journal of anatomy.* Quarterly. London: Cambridge University Press. Forty shillings. [£2.0]

*Journal of the Chemical Society.* Monthly. London: Chemical Society. Seventy-five shillings. [£3.75]

*The journal of endocrinology.* Irregular. London: Cambridge University Press. Thirty-five shillings [£1.75] (per volume of four issues).

Original research on the endocrinology of lactation.

*The journal of physiology.* Irregular. London: Cambridge University Press. Forty-five shillings. [£2.25]



*The journal of the Royal Society of Arts.* Twenty-six times yearly. London: Bell and Sons. Sixty-three shillings. [£3.15]

Lectures to the Society on general topics have included dairy-education, physiology of lactation, nutritive value of milk and milk-products, the dairy industry, etc.

*Journal of scientific instruments.* A publication dealing with their principles, construction and use, and the applications of physics in industry. Monthly. London: Institute of Physics. Forty shillings. [£2.0]

*Journal of the Society of Chemical Industry.* Monthly. London: Society of Chemical Industry. Thirty-five shillings. [£1.75]

Original work on the chemistry of milk and milk-products.

*Monthly digest of statistics.* Monthly. London: His Majesty's Stationery Office. Thirty-two shillings and sixpence. [£1.625]

Official statistics of production, manufacture, imports, utilization, etc., of milk and milk products.

*Nature.* Weekly. London: Macmillan. Ninety shillings. [£4.5]

*Nutrition abstracts and reviews.* Quarterly. Bucksburn, Aberdeen: Imperial Bureau of Animal Nutrition. Forty-two shillings. [£2.1]

Abstracts covering the whole field of both human and animal nutrition, with an authoritative review-article in each issue.

*Proceedings of the Nutrition Society.* Quarterly. Cambridge: Hefner and Sons. Twenty-five shillings. [£1.25]

This journal will be superseded by *The British journal of nutrition* (see above).

*Proceedings of the Royal Society. Series B. Biological sciences.* Irregular. London: Cambridge University Press. Thirty-two shillings [£1.6] (per volume).

*The scientific proceedings of the Royal Dublin Society.* Irregular. Dublin: Royal Dublin Society.

*Transactions of the Faraday Society.* Monthly. London: Faraday Society. Sixty shillings. [£3.0]

*Transactions of the Institution of Chemical Engineers.* Annual. London: Institution of Chemical Engineers.

## B. BOOKS

*This list has been limited, with one exception, to books published in 1930 or later years. Books dealing with science rarely have a useful life of more than fifteen years nowadays: the need to restrict the labour of compilation likewise suggested such a limitation. Doubtless many even of these recent books are out of print. Unfortunately editions are so small and sell out so rapidly that it is quite impossible to give any indication of availability. Data given are author's name, title of the book, number of the edition, date and place of publication, publisher, price, whether illustrated or containing a bibliography.*

### 1. Milk-production

#### a Dairy-farming

Cole, W. E. *Systems of dairy farming.* (College of Estate Management: Reports of the college travelling scholars in agriculture, No. 1.) 1st ed., 1930, London: College of Estate Management. (Printed for private circulation.) Illustrated. Bibliography.

The report covers the United Kingdom and the chief dairying countries of Europe.

Cookson, B. M. *Dairy cows and their management.* 1st ed., 1944, London: Faber and Faber. Five shillings. [£0.25] Illustrated.

A simple guide for beginners.

Duckham, A. N. *Animal industry in the British Empire.* A brief review of the significance, methods, problems, and potentialities of the live-stock and dairying industries of the British Commonwealth. 1st ed., 1932, Oxford: University Press. Fifteen shillings. [£0.75] Illustrated. Bibliography.

Fishwick, V. C. *Dairy farming. Theory and practice.* 1st ed., 1947, London: Crosby Lockwood. Fifteen shillings. [£0.75] Illustrated.

Half the book is devoted to descriptions by twenty farmers of their own farms and methods.

Foot, A. S. *Observations on American dairy husbandry.* (College of Estate Management: Reports of the college travelling scholars in agriculture, No. 5.) 1st ed., 1937, London: College of Estate Management. (Printed for private circulation.) Illustrated. Bibliography.

Garner, F. H. *British dairying.* 1st ed., 1946, London: Longmans, Green. Twenty-one shillings. [£1.05] Illustrated.

Gunn, E. *Farm buildings, new and adapted.* 2nd ed., 1945, London: Crosby Lockwood & Son. Ten shillings and sixpence. [£0.525] Illustrated. Bibliography.

Holmes, W. O'C. *Family goat keeping.* A "Goats" magazine handbook. 1st ed. [no date], Colchester: Trinity Printing Works. One shilling and sixpence. [£0.075] Illustrated.

Hoyland, A. *Machine milking. A bane or a boon?* 1st ed., 1939, London: Nicholls. Two shillings. [£0.1]

Robinson, H. G. *Good milk farming.* 1st ed., 1946, London: Hodder and Stoughton. Three shillings and sixpence. [£0.175] Illustrated.

#### b Feeding cattle

Ellis, J. C. B. *The feeding of farm live stock.* 1st ed., 1937, London: Crosby Lockwood. Fifteen shillings. [£0.75] Illustrated.

Hall, A. D. *The feeding of crops and stock. An introduction to the science of the nutrition of plants and animals. Part 3. The nutrition of animals and man.* 3rd ed. (revised by J. Hammond), 1944, London: Murray. Four shillings. [£0.2] Illustrated.

Halnan, E. T. & Garner, F. H. *The principles and practice of feeding farm animals.* 1st ed., 1940, London: Longmans, Green. Fifteen shillings. [£0.75] Illustrated.

Phillips, R. *Goat feeding.* A "Goats" magazine guide-book. 1st ed. [no date], Colchester: Trinity Printing Works. Two shillings and sixpence. [£0.125] Illustrated.

Slade, R. E. & Watson, S. J. *The feeding of cattle.* 1st ed., 1942, London: Fertiliser and Feeding Stuffs Journal. Three shillings and sixpence. [£0.175]

#### c Breeds and breeding

British Friesian Cattle Society. *History of British Friesian cattle. With details, facts and figures relating to their performances, with statistical and historical information concerning their pedigrees, and with the history of the British Friesian Cattle Society, 1909 to 1930.* 1st ed., 1930, Lewes: Baxter. Seven shillings and sixpence. [£0.375] Illustrated.

Cochrane, E. R. *The milch cow in England. A plea for constructive breeding.* 1st ed., 1946, London: Faber and Faber. Sixteen shillings. [£0.8] Illustrated. Bibliography.

Garner, F. H. *The cattle of Britain.* 1st ed., 1944, London: Longmans, Green. Eighteen shillings. [£0.9] Illustrated.

Hagedoorn, A. L. *Animal breeding.* 2nd ed., 1946, London: Crosby Lockwood and Son. Fifteen shillings. [£0.75] Illustrated.

Hammond, J. *Farm animals. Their breeding, growth and inheritance.* 1st ed., 1940, London: Arnold. Fourteen shillings. [£0.7] Illustrated. Bibliography.

Marson, T. B. *Scotland, the world's stud Shorthorn farm. A short account of some of Scotland's famous herds.* 1st ed., 1938, Edinburgh: Scottish Shorthorn Breeders' Association.

Nichols, J. E. *Livestock improvement in relation to heredity and environment.* 1st ed., 1944, Edinburgh: Oliver & Boyd. Ten shillings and sixpence. [£0.525] Illustrated. Bibliography.

Odlum, G. M. *An analysis of the Manningford herd of British Friesians.* Revised ed., 1945, Devizes: Wiltshire Gazette Printing Works. Thirty-one shillings and sixpence. [£1.575] Illustrated.

Tubbs, L. G. *The book of the Jersey.* 1st ed. [no date], Hitchin: Author (Beech House, Redcoats Green). Seven shillings and sixpence. [£0.375] Illustrated. Bibliography.

## 2. Economics

Cohen, R. L. *The history of milk prices. An analysis of the factors affecting the prices of milk and milk products.* 1st ed., 1936, Oxford: Agricultural Economics Research Institute. Five shillings. [£0.25] Illustrated. Bibliography.

Crawford, W. & Broadley, H. *The people's food.* 1st ed., 1938, London: Heinemann. Twelve shillings and sixpence. [£0.625] Illustrated.

Cripps, J. *The distribution of milk. A study of town delivery costs.* 1st ed., 1938, Oxford: Agricultural Economics Research Institute. Two shillings and sixpence. [£0.125]

An account of an investigation in four towns.

Dixey, R. N. *Tuberculin tested milk. A study of re-organization for its production.* 1st ed., 1937, Oxford: Agricultural Economics Research Institute. Two shillings and sixpence. [£0.125]

Dixey, R. N. *Open air dairy farming. A survey of farms using milking bails in 1940-1941.* 1st ed., 1942, Oxford: Agricultural Economics Research Institute. Two shillings and sixpence. [£0.125]

Dixey, R. N. & Messer, M. *Open air dairying. A survey of farms using milk bails in 1932.* 1st ed., 1933, Oxford: Clarendon Press. Two shillings and sixpence. [£0.125] Illustrated.

Drummond, J. C. & Wilbraham, A. *The Englishman's food. A history of five centuries of English diet.* 1st ed., 1939, London: Jonathan Cape. Twelve shillings and sixpence. [£0.625] Illustrated. Bibliography.

Murray, K. A. H. *Milk consumption.* 1st ed., 1937, Oxford: Agricultural Economics Research Institute. Two shillings and sixpence. [£0.125] Bibliography.

A review of earlier studies of factors affecting milk-consumption and an account of a survey in Oxford.

Murray, K. A. H. & Rutherford, R. S. G. *Milk consumption habits. Preliminary report.* 1st ed., 1941, Oxford: Agricultural Economics Research Institute. Two shillings and sixpence. [£0.125] Illustrated.

An account of an extensive survey in sixteen parts of Britain in 1938 and 1939.

Prewett, F. J. *A survey of milk marketing in Derbyshire.* June, 1928. 1st ed., 1930, Oxford: Clarendon Press. Two shillings and sixpence. [£0.125] Illustrated.

Prewett, F. J. *'Manufacturing milk.' A survey of milk marketing and utilization in West Cornwall.* 1st ed., 1932, Oxford: Clarendon Press. Two shillings and sixpence. [£0.125] Illustrated.

Prewett, F. J. *Problems of milk distribution.* 1st ed., 1932, Oxford: Clarendon Press. One shilling. [£0.05]

Smith, B. L. & Whitby, H. *Milk marketing before and after organization. A study in central Somerset.* 1st ed., 1937, Oxford: Agricultural Economics Research Institute. Two shillings. [£0.1] Illustrated.

## 3. Legal control

Ashford, E. B. & Savage, W. G. (editors). *The food and drugs act, 1938.* 1st ed., 1938, London: Eyre and Spottiswoode. Thirty-five shillings. [£1.75]

Dumsday, W. H. *Milk and dairies handbook, being the fifth edition of Hadden's handbook of the law relating to dairies, cow-sheds and milk-shops.* 1933, London: Hadden, Best. Fifteen shillings. [£0.75]

## 4. Physiology of milk-secretion

Burrows, H. *Biological actions of sex hormones.* 1st ed., 1945, Cambridge: University Press. Forty-two shillings. [£2.1] Bibliography.

Cameron, A. T. *Recent advances in endocrinology.* 5th ed., 1945, London: Churchill. Eighteen shillings. [£0.9] Illustrated. Bibliography.

Marshall, F. H. A. *The physiology of reproduction.* 2nd ed., 1922, London: Longmans, Green. Thirty-six shillings. [£1.8] Illustrated. Bibliography.

This book is included because it is a classic in its field and because a new edition, in two volumes, edited by A. S. Parkes, with contributions by numerous authorities, is in preparation and will appear shortly.

Marshall, F. H. A. & Halnan, E. T. *Physiology of farm animals.* 4th ed., 1946, Cambridge: University Press. Eighteen shillings. [£0.9] Illustrated.

Robson, J. M. *Recent advances in sex and reproductive physiology.* 2nd ed., 1940, London: Churchill. Fifteen shillings. [£0.75] Illustrated. Bibliography.

Waller, H. *Clinical studies on lactation.* 1st ed. [no date], London: Heinemann. Seven shillings and sixpence. [£0.375] Illustrated.

## 5. Dairy-chemistry

Bacharach, A. L. & Rendle, T. (editors). *The nation's food. A survey of scientific data.* 1st ed., 1946, London: Society of Chemical Industry. Eighteen shillings. [£0.9] Illustrated. Bibliography.

Clayton, W. *Colloid aspects of food chemistry and technology.* 1st ed., 1932, London: Churchill. Thirty-six shillings. [£1.8] Illustrated. Bibliography.

Clayton, W. *The theory of emulsions and their technical treatment.* 4th ed., 1943, London: Churchill. Forty-two shillings. [£2.1] Illustrated. Bibliography.

Davies, W. L. *The chemistry of milk.* 2nd ed., 1939, London: Chapman & Hall. Twenty-five shillings. [£1.25] Illustrated. Bibliography.

The most comprehensive and authoritative textbook available.

Elsdon, G. D. & Walker, G. H. *Richmond's dairy chemistry.* Revised and largely rewritten. 4th ed., 1942, London: Griffin. Thirty shillings. [£1.5] Illustrated. Bibliography.

Dairy-chemistry treated from the point of view of the public analyst. A new edition, by a different author, is reported to be in preparation.

Hilditch, T. P. *The chemical constitution of natural fats.* 2nd ed., 1947, London: Chapman and Hall. Forty-five shillings. [£2.25] Illustrated. Bibliography.

E. R. Ling. *A textbook of dairy chemistry. Vol. 1. Theoretical. Vol. 2. Practical.* 2nd ed., London: Chapman and Hall. Thirteen shillings and sixpence [£0.675]; ten shillings and sixpence [£0.525]. Illustrated. Bibliography.

Volume 1 gives an admirable, concise account of the chemistry of milk and milk-products.

Nicholls, J. R. *Aids to the analysis of food and drugs.* 6th ed., 1942, London: Baillière, Tindall and Cox. Four shillings and sixpence. [£0.225] Bibliography.

More than one-quarter of this very useful book for practising food-and-drugs chemists is devoted to milk and milk-products.

Reilly, J. *Milk and milk products. The vital foodstuffs.* 1st ed., 1942, Cork: Forum Press. One shilling. [£0.05] Illustrated.

## 6. Dairy-bacteriology

Baumgartner, J. G. *Canned foods. An introduction to their microbiology.* 1st ed., 1943, London: Churchill. Eight shillings and sixpence. [£0.425] Illustrated. Bibliography.

Chalmers, C. H. *Bacteria in relation to the milk supply. A practical guide for the commercial bacteriologist.* 3rd ed., 1945, London: Arnold. Eight shillings and sixpence. [£0.425] Illustrated.

Orla-Jensen, [S.] *Dairy bacteriology.* 2nd english ed. (translated by P. S. Arup), 1931, London: Churchill. Eighteen shillings. [£0.9] Illustrated. Bibliography.

Savage, W. [G.] *Practical public health problems.* 1st ed., 1941, London: Churchill. Ten shillings and sixpence. [£0.525] Illustrated.

## 7. Dairy-technology

Burdett, O. *A little book of cheese.* 1st ed., 1935, London: Howe. Illustrated. Bibliography.

A guide for the cheese-eater.

Cronshaw, H. B. *Dairy information.* 1st ed., 1947, London: Dairy Industries. Seventy shillings. [£3.5] Illustrated. Bibliography.

Dairy-science in one volume, omitting butter and cheese.

Crosbie-Walsh, T. (editor). *Food industries manual. A technical and commercial compendium on the manufacture, preserving, packing and storage of all food products.* 14th ed., 1945, London: Leonard Hill. Twenty-five shillings. [£1.25] Bibliography.

Nearly three hundred pages are devoted to an encyclopaedia of dairying compiled by J. G. Davis.

Enock, A. G. *This milk business. A study from 1895 to 1943.* 1st ed., 1943, London: Lewis. Eighteen shillings. [£0.9] Illustrated. Bibliography.

Hanley, J. (editor). *Progress in milk technology. Vol. 1. Knowledge extant at the beginning of the twentieth century.* 1st ed., 1936, Liverpool: Bibby & Sons. Eleven shillings and sixpence. [£0.575] Illustrated.

A summary of evidence presented in 1900 to a committee enquiring into standards of composition for milk.

Harvey, W. C. & Hill, H. *Milk products.* 1st ed., 1937, London: Lewis. Sixteen shillings. [£0.8] Illustrated.

Harvey, W. C. & Hill, H. *Milk: production and control.* 2nd ed., 1946, London: Lewis. Thirty-seven shillings and sixpence. [£1.875] Illustrated.

Hill, H. *Pasteurisation.* 1st ed., 1943, London: Lewis. Ten shillings. [£0.5]

Leitch, R. H. *Cheddar cheese-making. Faults in cheese.* 1st ed., 1932, Glasgow: Scottish Agricultural Publishing Co. Two shillings. [£0.1]

Murray, A. H. *The world's handbook of dairying. The standard book of reference to the dairy trade.* 1st ed., 1935, Wells: Clare, Son and Co. Five shillings. [£0.25] Illustrated.

A simple encyclopaedia of technical terms.

Walker-Tisdale, C. W. & Robinson, T. R. *Practical butter-making.* 7th ed. (revised and re-written by D. V. Dearden). 1934, London: Allen and Unwin. Three shillings and sixpence. [£0.175] Illustrated.

Farmhouse buttermaking.

Walworth, G. *Modern dairy management.* 1st ed., 1931, Manchester: Co-operative Union. Sixteen shillings. [£0.8] Illustrated.

Woodcock, F. H. & Lewis, W. R. *Canned foods and the canning industry.* 1st ed., 1938, London: Pitman and Sons. Seven shillings and sixpence. [£0.375] Illustrated.

Wilson, G. S. *The pasteurization of milk.* 1st ed., 1942, London: Arnold. Bibliography.

An authoritative review of the evidence for and against pasteurization.

# Notes on Contributors

MR. K. C. RICHARDSON is Reader in histology at University College, London. He was formerly Lecturer in anatomy in the University of Sydney. At present he is working in collaboration with Dr. Folley and his colleagues of the National Institute for Research in Dairying on the problem of the artificial induction of lactation in virgin goats.

DR. S. J. FOLLEY received his early training in the famous School of Chemistry at Manchester. As Mercer Scholar in Chemistry, he took a research degree in colloid chemistry, and then began research in physiological chemistry in the laboratory of H. S. Raper. He has been a member of the staff of the National Institute for Research in Dairying since 1932, and during the last ten years he has become widely known as one of the world's leading authorities on the endocrine control of lactation and reproduction. As a Rockefeller Foundation Fellow in 1938, he spent some time in the laboratory of the late Edgar Allen at Yale.

DR. H. D. KAY is director of the National Institute for Research in Dairying, and is also research professor of biochemistry to the University of Reading. He is a graduate of Manchester and of Cambridge. He studied biochemistry under Sir Arthur Harden at the Lister Institute, Sir F. G. Hopkins in Cambridge and Professor Franz Knoop in

Freiburg, became a member of the staff of the Medical Unit at the London Hospital in 1925, and later professor of biochemistry in the University of Toronto. His earlier research work was mainly on oxidations in the animal body, on the metabolism of phosphorus compounds, on enzymes (particularly the phosphatases and the reversibility of enzyme-action), on egg-yolk proteins and on milk-secretion. He was responsible for a biochemical technique now used to assist diagnosis of certain bone-disorders and, with W. R. Graham, devised a method, now official in Britain and widely employed abroad, for determining the efficiency of pasteurization of milk. At the National Institute for Research in Dairying, since 1933, he has initiated and directed research on many of the fundamental problems associated with lactation. He is a Fellow of the Royal Society.

DR. F. H. MALPRESS worked during the war years as an associate of Dr. S. J. Folley at the National Institute for Research in Dairying. His published work deals with studies on the hormonal control of reproduction and lactation, with particular reference to the dairy animal. Dr. Malpress was recently appointed Lecturer in biochemistry at Queen's University, Belfast.

PROFESSOR F. G. YOUNG began his career in 1929 as Bayliss-Stirling Scholar in biochemistry at University

College, London. In 1933 he became honorary research assistant at the department of physiology, University of Aberdeen, and in 1934 research associate at the department of physiology at the University of Toronto, returning in the same year to University College, London, as assistant in the department of physiology, pharmacology and biochemistry. From 1936-1942 he was a member of the scientific staff of the Medical Research Council at the National Institute for Medical Research, London. He served as joint honorary secretary (1938-1942) of the Biochemical Society and was chairman (1942-1946) of the editorial board of the *Biochemical Journal*. In 1942 he was appointed professor of biochemistry in the University of London at St. Thomas's Hospital Medical School (1942-1945) and then at University College (1945-). He is the author of some seventy publications relating to the influence of hormones on metabolism, with particular reference to the relation of the pituitary gland to diabetes.

DR. MARGARET ROBINSON has taken a special interest in the study of lactation in women. She was educated at Queen's University, Belfast. In 1941, while working as an Assistant Medical Officer for Maternity and Child Welfare in Liverpool, her attention was drawn to the higher morbidity- and mortality-rates of bottle-fed as compared with breast-fed infants. On the assumption that failure of lactation in the

## NOTES ON CONTRIBUTORS

mothers of bottle-fed infants was probably of endocrine origin, she consulted Dr. S. J. Folley (v. supra) and Prof. F. G. Young (v. supra) and has now been working for nearly three years on the effect of hormones on lactation in women. The Medical Research Council has given her a full-time grant, and the work is being carried out in the Maternity Units of St. Thomas's and University College Hospitals. Dr. Robinson is the author of several papers published since 1939 on breast-feeding and failure of lactation.

MISS JOSEPHINE BARNES is at present assistant in the Obstetric Unit at University College Hospital and assistant obstetrician and gynaecologist at the Elizabeth Garrett Anderson Hospital, London. She has specialized in obstetrics and gynaecology since 1939, and has held the appointment of graduate assistant in the Nuffield Department of Obstetrics and Gynaecology at the Radcliffe Infirmary, Oxford, and first assistant in the Obstetric Unit at University College Hospital. She has carried out clinical research-work on oestrogens and on early human ova and embryos, and has recently published results on the use of pethidine in labour.

DR. S. K. KON is head of the department of nutrition at the National Institute for Research in Dairying, where he has worked since 1930. From 1924 to 1927 he was assistant to Dr. Casimir Funk at the Warsaw School of Hygiene, and between 1927 and 1929 held a Rockefeller Travelling Fellowship. He is Honorary General Editor of the *Proceedings of the Nutrition Society* and member of the editorial board of the *Biochemical Journal*. He has published numerous papers on various aspects of nutrition, and has been specially interested in the value of milk as food, in problems of nitrogen- and calcium-metabolism, and of the intestinal synthesis of vitamins.

PROFESSOR B. S. PLATT was the subject of a biographical note in this journal (*BMB*, 2, 200) in 1944. Since then he has been a member of the UK delegation to the United Nations' Food and Agriculture Organisation Conference at Quebec (1945), the UK delegation to the second Food and Agriculture Organisation Conference at Copenhagen (1946) and the Special Advisory Committee on Nutrition to the Director-General. In 1946 he was appointed professor of nutrition at the University of London, and head of the department of nutrition at the London School of Hygiene and Tropical Medicine.

PROFESSOR ALAN MONCRIEFF is well-known as one of Britain's leading paediatricians, and is the first holder of the Nuffield Chair of Child Health in the University of London. He is a member of the staff of the Hospital for Sick Children, Great Ormond Street, London, and director of the Institute of Child Health which came into being there in January 1946. Professor Moncrieff is the author of many publications on paediatric subjects.

DR. HAROLD WALLER is superintendent medical officer to the Royal College of St. Katherine, Poplar, and paediatrician at the British Hospital for Mothers and Babies, Woolwich and at the Poplar Hospital. He is the author of *Clinical studies in lactation* (1938) and of papers on breast-feeding. He believes that a baby thrives best if successfully fed at its mother's breast and that mothers have been inadequately taught how to do this.

DR. JEAN M. MACKINTOSH has been Senior Assistant Medical Officer for Maternity and Child Welfare for the City of Birmingham since September 1943. She is also part-time Reader in the University Department of Child Health. Previously she held appointments as regional medical officer for maternity and child-welfare, City and County of Aberdeen and County of Kincardine (1938-1943), Assistant Medical Officer of Health for maternity and child-welfare, Stockport (1928-1938), and Assistant Medical Officer of Health and assistant school medical officer, Llanelly (1923-1928). She has published papers on anaemia in pregnancy and on infant-feeding.

PROFESSOR J. R. MARRACK was appointed chemical pathologist to the London Hospital in 1919 and Professor of chemical pathology in 1934. He has carried out investigations on the nature and reaction of antigens and antibodies and published *The chemistry of antigens and antibodies* (London, 1938; MRC Special Report Series, No. 230) and, jointly with Dr. (now Sir Phillip) P. N. Pantón, a standard work on *Clinical pathology* (1945). He has also published a number of papers on antigen-antibody reactions and is, at present, engaged in research on various aspects of clinical pathology.

PROFESSOR J. H. BURN has previously contributed to the Bulletin a paper on "The testing of local anaesthetics" (*BMB* 816), with which a note on his work was published.

DR. J. SMITH is Deputy Medical Officer of Health for the City of Aberdeen, a Lecturer in the public-health department of Aberdeen University, and the director of the Municipal and Regional Public Health Laboratory Services for the North-Eastern Area of Scotland. He has been much interested in the application of modern bacteriological technique to the elucidation of many problems connected with the epidemiology of infectious diseases. For instance, he was able to prove definitely that streptococcal infection in puerperal women is more frequently derived from exogenous than endogenous sources. His published work includes papers on the etiology of puerperal fever, new types of *Salmonellas*, the incidence of leptospiral infections in fish-workers, and the incidence and distribution of undulant fever.

MR. A. ROWLANDS is a member of the staff of the bacteriology department of the National Institute for Research in Dairying. Before his appointment to this post in September 1945, he was advisory bacteriologist and head of the bacteriology department at the Midland Agricultural College, a post which he occupied for a period of 17 years. Throughout his career he has been in close touch with the practical problems involved in controlling the bacteriological quality of milk through the stages of production, processing, and distribution. Mr. Rowlands has made a special study of methods of testing pasteurized milk, and the results of his investigations led to the adoption of the methylene-blue test for the official examination of pasteurized milk. During the summer of 1946, he visited the USA as a member of a mission appointed by the British Ministry of Agriculture to study methods of milk-production and control in North America.

MR. J. MCCLEMONT is a graduate in agricultural science of Glasgow University, and holds the National

Diplomas in Dairying and Agriculture. After a short period on the staff of the West of Scotland Agricultural College he went to the National Institute for Research in Dairying as research assistant in dairy husbandry. In 1927 he was appointed to the post of adviser in dairy bacteriology on the staff of Reading University, and in October 1946 was transferred to the National Agricultural Advisory Service as specialist officer in bacteriology. Mr. McClemont's main interest has been the bacteriological control of milk. His published work includes papers on the accuracy of the plate (colony) control for milk and the influence of mastitis on the tests used in milk-control. As an adviser his work has consisted of the investigation of bacteriological problems arising during the production and handling of milk, and the interpretation of the results of dairy-research to the industry.

DR. J. G. DAVIS was formerly head of the section of bacterial metabolism at the National Institute for Research in Dairying. He is now a Director (Technical) of the Express Dairy Company, and also a Director of Industrial and Scientific Instruments Ltd. Dr. Davis has worked principally on the bacteriology and biochemistry of milk and milk-products, and especially on the lactic-acid bacteria, cheese-ripening, bacteriological tests for milk-mastitis, and bacteriological media. His present interests are in routine control-tests in the dairy-industry, new types of detergent, and new scientific instruments for the dairy- and food-industries. He has published a number of original papers on various aspects of dairying bacteriology, and is preparing a Dictionary of Dairying and a book on cheese.

MR. E. B. ANDERSON has had an extensive and varied experience of industrial chemistry. He spent five years as research chemist to John Power & Sons, Ltd., distillers, of Dublin—the first post of this nature in Ireland. For three years during the 1914-18 war he was in the nitroglycerine section of the Royal Gunpowder Factory, Waltham Abbey, and for five years a technical research chemist at the British Dyestuffs Corporation, Blackley, Manchester, in charge of a section on chrome-azo-dyes and their intermediates. A further five years was spent as chemist and manager of a creamery and spray-dried-milk plant in Devonshire, after which he was appointed to his present post of chief chemist to United Dairies, Ltd., and its sub-companies. In this capacity he is concerned with all the research and control work applied to milk and its products, i.e. butter, cheese, milk-powder, condensed and evaporated milks, milk-sugar, etc., and the general problems arising in any big manufacturing company. He is joint honorary secretary of the Society of Chemical Industry, and a member of several learned societies.

MR. W. G. SUTTON was formerly lecturer in dairy chemistry and dairy bacteriology at Massey Agricultural College, University of New Zealand. In 1938 he came to England to start the Imperial Bureau of Dairy Science, of which he is Director. The Bureau scans the world literature relating to milk and milk-products and distributes the collected information to dairy-scientists. Mr. Sutton edits the Bureau's journal *Dairy Science Abstracts* and is in a unique position to survey the literature of dairy-science.

IN previous volumes the Bulletin contained, in addition to the scientific symposium which occupied the greater part of each number, subsidiary sections of bibliographical and historical interest. Starting with the first number of Volume 5, the Bulletin has been clearly divided into two parts. The collective monograph on a special subject which had become the characteristic feature of the Bulletin now constitutes Part I. Part II contains miscellaneous articles on medical subjects of scientific, bibliographical, and historical interest. The book-review section is extended and there are, as before, sections devoted to historical notes, film-reviews, and lists of contents of current British medical and cognate periodicals. It is our intention that Part II should be a medium for extending the range of interest of each number of the Bulletin and for enhancing its continuity as a periodical.

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## Annotations & News

Water-supply—Are syphilis, yaws, bejel, and pinta manifestations of an etiologically-identical disease?—Grüneberg and Darlington on genetics—Progress in the war against the louse—A new kind of medical textbook—Despotism in the family—Colour-vision—Work of the Lister Institute—An Argentine view of British medicine and science—Journals newly received.

## Historical Notes

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## Book Reviews

Anatomical terms—Der Blutspender—Metabolic therapy of cancer—Cardiovascular disease in general practice—Heart arrhythmias in children—Heparin in the treatment of thrombosis—Recent advances in clinical pathology—Chemical methods in clinical medicine—Die Milzpunktion—Special or dental anatomy and physiology and dental histology—Dental materia medica, pharmacology and therapeutics—Chemistry and metallurgy of dental materials—Dental assistant's handbook—Practical handbook of the pathology of the skin—Diseases of the skin—Introduction to dermatology—

Child health—Diseases of children—Diseases of children's eyes—Skin diseases in children—Recent advances in endocrinology—Leitfaden für Zuckerkrankhe—Food and health—Milk: production and control—Acute infectious fevers—Infectious diseases—Human torulosis—Further studies in encephalography—Nutritional disorders of the nervous system—Medical disorders of the locomotor system including the rheumatic diseases—Law relating to hospitals—Municipal health services—Preventive medicine and public health—The microscope—Psychological disorders in flying personnel—Treatment of impotence—Textbook of surgical treatment—Introduction to surgery—Student's handbook of surgical operations—Textbook of obstetrics—Postgraduate obstetrics—Short textbook of midwifery—Principles and practice of tropical medicine.

## Shorter Notices

Vitamine, Hormone, Fermente—La linfogranulomatosis inguinal subaguda o cuarta enfermedad venerea—Lo que todo el mundo debe saber sobre la sífilis—101 Clinical demonstrations to nurses—Les septicémies à staphylocoques—Microbiological assay of the vitamin B complex—Übersicht der gebräuchlichen und neueren Arzneimittel—Estudos cirúrgicos—Manual de alergias—Chemotherapy yesterday, to-day, and tomorrow—Care of children from one to five—Primeros cuidados a un accidentado—Approach to social medicine—L'année médicale pratique—Handbook of physiology and biochemistry—Science of seeing—L'œuvre des Pasteurs en Afrique Noire—Les contagions de la syphilis—Practical handbook of psychiatry for students and nurses—Nursing and diseases of sick children—Medizinische Mikrobiologie—Art of nursing—Birth of a child—Surgical note-taking—Eye surgery—Meningitis meningococcica en la infancia—Spiders, ticks and mites—Principles of the contact lens—Elements of surgery—Womanhood—X-rays—The human approach.

## Books Received

## Guide to the Journals



## ROBERT STENHOUSE WILLIAMS AND THE ORIGIN AND EARLY DEVELOPMENT OF THE NATIONAL INSTITUTE FOR RESEARCH IN DAIRYING

H. F. BURGESS A.C.I.S.

*Secretary, National Institute for Research in Dairying  
University of Reading*

The early history of the National Institute for Research in Dairying is largely a chapter in the biography of one man—Robert Stenhouse Williams—whose energy and vision motivated and guided its development from its beginnings as a very small team of research-workers to a well-established institute with an international reputation. He was himself essentially a modest man, and one who had the welfare of his fellow-creatures very much at heart. He had a large vision of his work, which he saw as a contribution to the betterment of mankind. As a medical man he realized its relation to human health, and he fought for his ideals persistently and courageously, yet with patience and forbearance, and with due appreciation of the other man's point of view.

Thorough in all he did, he looked for the same quality in his staff, to whom he was loyal and devoted, as were they also to him. Never inclined to take credit to himself, he was always concerned to ensure that full credit should go to the members of his staff. His relations with them were almost paternal, and were reflected in innumerable acts of kindness and consideration. Outside the Institute he was tireless in his efforts to give help and advice wherever they were needed. He was altogether a remarkable and lovable personality.

Robert Stenhouse Williams was born in Liverpool in 1871, and was the son of a medical man. After qualifying in medicine and surgery at Edinburgh University, he returned to Liverpool as Assistant Bacteriologist in the Public Health Department of the University. He also held several lectureships on public health and bacteriology in Liverpool, as well as hospital appointments. He worked also for a period in the laboratory of Professor Weinberg at the Pasteur Institute. He had thus acquired a thorough training in bacteriology and a wide experience in the practical applications of the science which were to prove an excellent preparation for his life's real work, on which he entered in 1912.

### Beginnings of the Institute

In that year, two senior posts—Research Bacteriologist in Dairying, and Research Chemist in Dairying, were created at University College, Reading (now the University of

Reading), by the aid of a grant from the Development Fund. That fund had been established in 1909 with the object, among others, of aiding and developing British agriculture and, as part of the plan for achieving that object, centres of research were established in various parts of the country. The two posts at Reading constituted the modest provision made initially for dairying. Stenhouse Williams was appointed Research Bacteriologist, and the post of Research Chemist went to the late John Golding, who came to Reading from the Midland Agricultural College.

The Institute thus started with two members of staff. Its income was of the order of £2,000 per annum, of which rather less than half was absorbed by salaries. The remainder had to cover maintenance-costs, and the facilities which could be provided for the work were correspondingly modest. The Institute was housed in part of a private dwelling-house, and its accommodation was very inconveniently distributed between attic and cellar.

The first task of the newly-appointed staff was to create laboratories. Two or three attic-rooms, and one room in the cellar, were adapted to this purpose. Another attic-room contained the nucleus of the library, mainly Stenhouse Williams' own collection of books. A small assistant staff was also appointed, consisting of two laboratory assistants, and a graduate "Assistant for Publications" who, in addition to having charge of the "library", was also responsible for the clerical work.

The Institute had no cows and no experimental dairy of its own, and it depended on the co-operation of those in charge of the College Farm and the British Dairy Institute in the conduct of experiments on milk-production and on the preparation of dairy-products. Stenhouse Williams was always generous in his tributes to the help he received from these sources, but it was obvious that such help could be only very limited. The farm and dairy were primarily teaching-centres, and their resources were barely sufficient for that purpose.

It was thus evident almost from the start that the work of the Institute would be handicapped until it had a farm and dairy under its own control, and it did in fact suffer from that handicap for seven years.

But the lack of all but the bare minimum of facilities for the study of the problems of the dairy-industries was matched by an almost complete lack of information about those problems, and the only line of attack appeared to be to carry out such work as came to the laboratory, and to gather information as time progressed.

### Early Studies

One of the earliest studies was developed from the work of John Golding at the Midland Agricultural College on the discoloration of Stilton cheese. Further study at the Institute demonstrated that this fault was primarily due to dirt-organisms in the original milk. A survey of the conditions under which the milk was being produced led to the study of the methods of milk-production—a study which was to form the basis of the work of the Institute for some time to come, and which was to play an important part in the development of what came to be known as the clean-milk campaign.

It is perhaps difficult in these days to realize the nature and fundamental importance of the truly pioneering work carried out by Stenhouse Williams and his colleagues in the course of

this campaign. The conditions under which milk is produced and handled have been so improved, largely as a result of the efforts of themselves and their collaborators, that the difficulties with which they had to contend are apt to be forgotten. Conditions on many farms were primitive. Water-supplies were dirty and inefficient, cows were living and milk was being produced under insanitary conditions. In many cases no consideration was given to the cleanliness of the cows or of the milkers. Even on the better farms, where buildings and other facilities were of a higher standard, there was still a lack of understanding of how to make the best use of them. Methods of production and handling left much to be desired. The management of the milk at the receiving depots was equally unsatisfactory, where very little attention was given to the adequate cleaning and sterilization of the churns.

Stenhouse Williams and his colleagues were able to demonstrate that these conditions were the cause of very considerable losses to the industry, and they were further able, as a result of a long series of experiments, to suggest remedies. But there was no economic inducement to the farmer to apply those remedies, and much apathy and misunderstanding had to be overcome. Furthermore, the importance of milk as a foodstuff in the national dietary was not fully realized even by the medical profession. A further cause of the unsatisfactory state of the industry was inadequate technical education, for which the lack of well-equipped dairy-schools was partly responsible. There was no provision for practical instruction in proper methods of milk-production, and no collaboration between the production of milk in the cowshed and the preparation of dairy-products in the dairy-school.



**ROBERT STENHOUSE WILLIAMS 1871-1932**

Founder of the National Institute for Research in Dairying

The improvement of dairy-education was, then, another of the objectives which Stenhouse Williams set himself to help to achieve, partly by means of Clean Milk Competitions and partly by arranging lectures and demonstrations at the Institute for those engaged in dairy-teaching, and by undertaking a considerable burden of lecturing.

Two other important lines of research were started in these early years, the study of acidity in relation to dairy-products and of the viability of the tubercle bacillus on pasture-land. In connexion with the latter experiment, the Institute rented a small piece of pasture-land with a small wooden shed where two or three cows excreting tubercle bacilli in their faeces were kept for study. These were cared for by a lady who, it is amusing to note, is described in an early record of those days, as "Assistant in charge of farm".

#### The War-period: 1914-1918

In 1914, it appeared as though the work would be stifled by the outbreak of war. John Golding and his two laboratory assistants joined the Army, and until Golding's return in 1919, Mrs. E. C. V. Mattick, who had been a Ministry of Agriculture Research Fellow at the Institute, undertook the supervision of the chemical laboratory.

Nevertheless, an important development took place during the war-period for, in 1916, a small Committee of persons interested in the Institute was formed under the Chairmanship of the late Ernest Mathews to act in collaboration with the College in developing the Institute. The Committee had two main objectives: (i) to remove the severe handicaps imposed on the work by lack of adequate laboratories and a farm and dairy and (ii) to obtain more definite knowledge

than had hitherto been available of those problems of the industry calling for scientific investigation. The immediate pursuit of the first objective was rendered difficult by the war. The second had in some ways been rendered more urgent by the war. A Sub-Committee was appointed to conduct an inquiry into the extent of the losses incurred by the milk- and dairy-industries through bad methods of milk-production and -distribution. Its findings confirmed and extended the conclusions on this matter derived from the work on the discoloration of Stilton cheese, and led to a study of losses due to faulty handling and distribution of milk, and to the publication of a series of papers on sources of contamination and methods of prevention.

Thus, the main lines of work tended to develop in three directions: the production, handling, and distribution of milk; the importance of acidity in dairy-products; and the prevention of disease in cattle, a development of the original work on tuberculosis.

These researches took the staff into the field and brought them into direct touch with the milk-producer and -distributor. Stenhouse Williams himself established contacts which were to develop into lasting friendships and to gain many enthusiastic supporters for his work. In this way also the Committee was assisted in its efforts to bring the needs of the Institute to the notice of those whom it was intended to serve.

#### 'The National Institute Founded

As soon as the war was over, an Appeal Committee was formed under the chairmanship of the present Earl of Iveagh, and the campaign for raising funds was intensified.

In 1920, a new chapter in the history of the Institute was opened. John Golding had returned in the previous year to resume his post as Research Chemist, and the staff had been further strengthened by the appointment of James Mackintosh as Head of a Section of Dairy Husbandry, created in anticipation of the acquisition of a farm and dairy.

The Appeal Committee had collected funds sufficient, with grants from the Development Fund and generous help from Lord Iveagh, to purchase the Shinfield Manor Estate of some 357 acres<sup>1</sup>. At the same time, the government of the Institute was delegated, by Deed of Trust executed by University College, Reading, to an independent Board comprising representatives of the College, the Ministry of Agriculture, the Ministry of Health, the Royal Agricultural Society of England, the National Farmers' Union, the British Dairy Farmers' Association, the Staff of the Institute, and individual subscribers to the Trust funds and others interested in the milk industries. At this time, also, the title of the Institute was changed to the "National Institute for Research in Dairying". With the establishment of the Board, the old Committee of Dairy Research came to an end.

The primary objects of the Trust were to ensure that monies and other property given for the purposes of the Institute should be legally secured for those purposes, to give the governing board a large measure of autonomy, and by these means to strengthen its hand in appealing to the public for additional funds. And additional funds were urgently needed, for although the Institute had acquired its farm, it was still lacking adequate buildings. The Manor House,

which before acquisition by the Institute had been occupied as a private dwelling, had to be converted for use as laboratories; services of heat, light, power and water had to be provided. A dairy and some modern farm-buildings had to be erected.

The years 1920-23 were very much occupied in planning and erecting the new buildings. In the meantime, the laboratory work was continued in the original primitive laboratories. The new farm, however, was occupied in 1920, and in spite of the inadequacy of the buildings, much experimental work on the handling of whole milk and the preparation of dairy-products was carried out. An ill-lighted wooden cowshed with a thatched roof and bare earthen floor was "modernized" at a small cost by the provision of concrete floor and standings—the minimum provision necessary to enable the place to be kept clean—and here Stenhouse Williams and his colleagues were able to demonstrate that methods were of more importance than expensive housing and equipment in the production of clean milk. Another wooden shed was adapted as a dairy and cooling-room by the introduction of a concrete floor and the use of whitewash. All water for the cowshed and dairy had to be carted by hand from an ordinary well-pump.

These primitive buildings were preserved and used for some years to demonstrate what could be achieved under conditions which, at most, were no better than those to be found on the majority of British farms.

During this time, the Appeal Committee continued to be actively engaged in raising funds to pay for the new buildings. In this work, Stenhouse Williams played a leading part. He would take advantage of every opportunity to make known the needs of his Institute, and the financial records of those times bear testimony to his activities in the long lists of individual donations, ranging from a few shillings to several pounds, which he was personally instrumental in collecting. He was also able to demonstrate in a practical way how the Institute could help in solving the problems of the industry, and he valued even more than the financial support the widespread interest which was developed in the work of the Institute.

The problem of raising capital funds was not the only one confronting Stenhouse Williams and his supporters. A larger income was also needed, and in the stringent financial circumstances of 1920 it was very much a matter of cutting one's coat according to one's cloth. The total available income in that year was about £5,000, most of which was derived from Government grant, and the Minute books of the time show that several meetings of the Staff Committee were held to consider how to keep within the budget.

It appears that in the result the irreducible minimum of expenditure exceeded the income by about £250!

#### The Professional Committee

It may be appropriate here to make further reference to the Staff Committee. This Committee, known as the Professional (Staff) Committee, was created very soon after the establishment of the Institute, at the instigation of Stenhouse Williams, and consisted of himself, his senior colleagues, and one or two collaborators on the Staff of University College. It was responsible broadly for the internal control and supervision of the work of the Institute. There was no Director in those days, the staff was very small, and the

<sup>1</sup> [1 acre = 0.4 hectare.—Ed.]

relations between its members were in consequence personal and intimate. The Committee system of control appeared to be most appropriate to these circumstances and, moreover, accorded with Stenhouse Williams' own belief that the staff ought to share the credit for and the burdens of the development of the Institute. The Chairmanship of the Committee was an elective office, although he himself was invariably voted to the Chair.

In that position he regarded himself as first among equals, and for long he steadfastly set his face against the creation of the office of Director. It was only when his administrative duties became so heavy that he clearly could not combine them with the duties of Head of the Bacteriology Department, that, on pressure from his colleagues, who freely acknowledged his leadership, he accepted the title of Director. He was largely influenced in this decision by his recognition of the fact that in fairness to the colleague who was in factual control of the Bacteriology Department, he himself could no longer continue to be titular head.

The Professional Committee, however, continued in being under the Chairmanship of the Director. Its governmental functions have been absorbed by the Board or vested in the Director, but it still performs important advisory functions.

In 1923, the Institute completed its move to its new home. By this time, the staff had been organized in three main departments—Bacteriology, under Stenhouse Williams, Chemistry, in charge of the late John Golding, and Dairy Husbandry under James Mackintosh.

There was now a Scientific Staff numbering ten in all, with seven laboratory assistants, a Librarian and a small secretarial staff. The Scientific Staff was soon increased by the appointment of a Head of the new experimental dairy, and the creation of a small Department of Physiology.

#### A Scheme of Development

The Institute was now able to begin the work of extending and developing its programme in accordance with a scheme already worked out by the Professional Committee and approved by the Board.

It is not possible here to give an account of that development, which can properly be regarded as the beginning of a stage in the progress of the Institute outside the scope of an article on its early history. The following extract from a report on the scheme, prepared in 1920, may however be of interest. It indicates the nature and objectives of the scheme, and also shows how the early pioneering work had led the staff to a realization of the problems calling for investigation.

"The future work of the Institute should be designed to meet the needs of the Milk and Dairy Industries. These needs are primarily research and advice to enable products of the highest quality to be produced under conditions which give rise to the least wastage and are consistent with economical and efficient production.

The carrying out of this scheme requires that the Institute shall have as complete a knowledge as possible of :—

- I. The chemical constitution and other properties of milk and milk products, including their food values.
- II. The different conditions of management of cows and their effects on the composition and properties of milk and dairy products.
- III. The chemical constitution, feeding value and other properties of foods given to cows and their effects upon milk and dairy products.
- IV. The methods of handling and distribution of milk and their effects on the chemical constitution and other properties of milk.
- V. The methods of manufacture of dairy products and their effects on butter, cheese, etc.
- VI. Methods of cropping, stock management and breeding and their relation to successful dairy farming.
- VII. Such other problems the study of which may seem advisable."

These new developments brought renewed financial anxieties which bore heavily on Stenhouse Williams and his staff. There was a debt of £26,000 on the farm and new buildings. There was very little income beyond the Government grant, and the future of several members of staff was very insecure as a consequence. Stenhouse Williams had therefore to devote much of his time in the next few years to the effort of raising funds, an effort in which he was ably assisted by the late Samuel R. Whitley, who became Treasurer of the Institute. This effort involved him in constant writing and public-speaking, which undoubtedly affected his health. His last act was to fulfil a public engagement in Ireland, in February 1932, though obviously unwell. He was taken ill in the train on his way home and died in University College Hospital within a few hours of the time of arrival of his train at Euston. He was in his 61st year.

For twenty years he had devoted all his mind and energy to the creation and development of the National Institute for Research in Dairying. To begin with, he had to fight prejudice and lack of understanding of his objectives. By the end, he had spread the fame of the Institute far beyond the bounds of Britain, and had won for himself a deserved reputation as a pioneer in the application of science to the milk- and dairy-industries.

It was inevitable that he should not have achieved all that he had hoped to achieve. His vision of an Institute of the size and importance commensurate with the magnitude of the industry it is designed to serve had not yet been realized.

But under the guidance of his successor, the present Director, Professor H. D. Kay, the Institute has grown in capacity and in reputation. New buildings have been added, departments of Nutrition, Lactational Physiology, Engineering, and Feeding and Metabolism have been created, and the staff has increased in numbers. There are now about fifty graduate scientific workers in the Institute, and about eighty other staff. Much more is still needed. All laboratories are grossly overcrowded, and the staff is still inadequate. But the vision of Stenhouse Williams, which is shared by his successor, may one day come true.

\* \* \*

## IS THERE A DECLINE OF INTELLIGENCE IN BRITAIN?

### A Review of Sir Cyril Burt's *Intelligence and Fertility*

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In this pamphlet<sup>1</sup>, originally prepared for the Royal Commission now enquiring into the trend of population in Britain, the distinguished psychologist, Sir Cyril Burt, discusses his reasons for believing that the average level of intelligence in the country is declining. It is an observed fact that the average intelligence-test scores of children from large families are lower than those of the members of small families. If test-results are measures of inherited mental capacity, it follows that the less-intelligent sections of the parental generation are reproducing more abundantly than the better endowed, and the population must be steadily deteriorating in intellectual quality. On the basis of the observed mean family-sizes of London children at different grades of intelligence, Sir Cyril calculates the fall as about 1.9 points in the mean intelligence quotient (I.Q.) per generation. If such a fall were to continue, he estimates that in little over fifty years the number of children of high ability (I.Q. of more than 130) would be halved, and the number of feeble-minded children doubled.

Unlike many of his sensation-mongering self-appointed popularizers, Sir Cyril clearly recognizes that this conclusion, based on extrapolations into the past and future from a series of tests all made at the one time, is far from being firmly established. The direct evidence at his disposal—test-results in the same area at different times—is not very reliable. So far as it goes, it indicates that the magnitude of the decline is much exaggerated by his indirect calculations. He also points out that

“an educational psychologist, familiar with the watchfulness of teachers, would expect that, if a decline of this size had been going on for at least a generation, many of the older head-teachers and officials would assuredly have noticed some of the incidental effects—a decrease in scholarship ability or an increase in the dull and mentally defective.”

He therefore urges suspension of final judgement pending the results of a properly-planned large-scale enquiry.

I have carefully worked through the arguments and calculations advanced by Sir Cyril Burt, Professor Godfrey Thomson, Dr. R. B. Cattell and others, purporting to show that national intelligence is declining, and in my opinion they have no case. Indeed, there is some evidence, too weak however to amount

to a proof, suggesting that the average mental ability of the population is rising. Underlying all these computations is the basic assumption that intelligence-test scores are completely determined by heredity, so that one can infer the average intelligence of a group of parents from the test-scores of their children. It is indeed true that Burt, Thomson and some of the others agree verbally that test-scores are also influenced by environment, but this admission does not enter into their arithmetic. Yet my detailed calculations show that environmental factors, even on the most conservative estimate of their importance, are sufficiently powerful to account for all the disparities in test-scores that constitute the evidence for the alleged decline in intelligence. I will return to this question later. Meanwhile, I propose to make the point that, even on the assumption that heredity is all-powerful, the computations of Sir Cyril Burt and the others still contain serious fallacies all tending to magnify greatly the size of the apparent decline.

In the first place, the methods used for calculating family-sizes at different degrees of intelligence are obviously incorrect. Burt's figures for average number in the family range from 2.3 for scholarship children to 4.7 for the feeble-minded. It is easy to demonstrate that these figures imply a reproduction-rate of well above unity, whereas it is notorious that the population is failing to maintain itself. It is fairly clear that Burt must have used the biased method of calculating family-sizes that was exposed by Yule and Greenwood in 1914. When this source of error is corrected, the apparent decline in intelligence shrinks by nearly half.

Secondly, Burt postulates that the average size of family increases steadily with declining intelligence of the parents. This is contrary to all the evidence. All the investigations I have been able to trace, both in Britain and America, agree that the maximum of fertility is reached when one parent is on the borderline of deficiency, parents of lower intelligence than this showing a steady fall in the number of children. Burt's estimate of how far we are breeding preferentially from the least intelligent is therefore much exaggerated.

This conclusion is greatly reinforced by a consideration of the third source of error in Burt's calculations. His method of computation necessarily takes into account only those adults who have one or more children. Sir Cyril is of course aware of this, and notes that allowance should be made for childless adults. He takes it for granted, however, that childlessness is most common at the higher intelligence-levels, so that this allowance would increase the magnitude of the apparent decline. It is true, of course, that the late marriages of professional men, and the marriage-bar on female teachers and civil servants, favoured childlessness among people of high ability. But on the other hand, there is almost certainly a much higher incidence of infertility at the lowest intellectual levels. Only a very small proportion of imbeciles, and virtually no idiots, ever have children. In his thorough ascertainment of mental defectives for a Government committee, Dr. E. O. Lewis found that nearly half the adult defectives were in institutions, where they would be prevented from breeding. Of those living at home, a large proportion of the men are unable either to attract a wife or support a family. Some defective women achieve notoriety by repeated illegitimate pregnancies, but they form only a small proportion of the total, and are far outnumbered by those who never reproduce. I am inclined to believe that childlessness among adults of low mental grade more than counterbalances that among the professional classes, so

<sup>1</sup> [For particulars see *Book Reviews*.]



that the net effect is an increase rather than a decline in the quality of successive generations.

Fourthly, Burt and the others commit the biological error of ignoring the genetic failures. When a graded character is determined solely by heredity, the parents will have the same average genetic composition as that of all the fertilized ova they produce. The new individuals may be aborted or still-born, they may die in childhood, they may reach reproductive age but remain childless, or they may reproduce. It is only this last group that Burt takes into account. Now human miscarriages amount to at least one-sixth of all pregnancies, and there are very cogent biological reasons, as well as much indirect and some direct evidence, for believing that a genetic constitution making for very low intelligence is also likely to favour abortion or early death. It requires only a very moderate incidence of potential mental deficiency among the abortions, stillbirths and early deaths to give a rise of average intelligence in each generation that will more than cancel the decline postulated by Burt and the others. I believe that a process of natural selection against low intelligence has probably been taking place in the human species since its inception, resulting in a slow rise in the average capacity of the survivors. This is naturally a very difficult thing to prove. But it is certainly completely unsound biologically to equate the average intelligence of a parental group with that of the fraction of their progeny who manage to survive the hazards of foetal life, birth, infancy and childhood.

My fifth criticism refers to another instance in which there is a discrepancy between the verbally-acknowledged facts and the assumptions built into the arithmetic. In calculating the alleged decline in intelligence, Sir Cyril assumes that all the parents of mentally-defective children were themselves defectives, while all parents of scholarship children were of scholarship ability. This is of course in flagrant contradiction to all experience. Indeed, Burt himself, in his book on *The subnormal mind*, reports an investigation on a group of mentally-defective London schoolchildren, where only 3 % of the parents were found to be defective. Other investigators get figures of about 15 %. When allowance is made for this error, a notable reduction occurs in the increase in mental defectives and in the decrease in persons of high ability to be expected in future generations.

When all these sources of exaggeration are allowed for, the alleged decline in intelligence shrinks from nearly 2 points of I.Q. to a much more modest figure, probably nearer to  $\frac{1}{2}$  than to 1 point. Nor can this difference be accepted at its face value. For, as Sir Cyril states in a footnote :

"... there is a further reason why it may be rather rash to deduce the relative intelligence of the parents from that of the children tested. There would seem to be a negative correlation between intelligence and order of birth. With my own cases it amounts to only -0.12... Since we are testing fairly young children, it would follow that, whenever we are dealing with members of a large family, we must usually be testing those who are late in order of birth; and... these will be the duller representatives of the family."

Sir Cyril does not state which of several possible methods he used in arriving at his correlation coefficient. But if he adopted the most probable procedure, one can calculate the correction to be applied to the apparent fall in intelligence because of the birth-rank effect. It turns out to be at least 0.6 points of I.Q., quite enough to cancel completely the corrected apparent difference between parents and children. In other words, even granting the assumption that only heredity matters, the numerical data presented by Burt

indicate no decline whatsoever in the average inborn mental quality of successive generations.

The birth-rank effect does more, however, than dispose of the residue of the apparent degeneration of the population. It challenges the whole set of assumptions on which the calculations are based. If a sixth or seventh child is on the average less intelligent than a first or second child, that cannot be due to genetic constitution. The difference must be environmental, a consequence of such things as less favourable conditions in an ageing uterus, worse nutrition in a family impoverished by more mouths to share the parental income, and the cultural and psychological disadvantages of being at the tail of a large family. Now the material and cultural environment of the older and younger children within the same home is relatively uniform compared with the contrasts between conditions in different homes at varying economic and social levels. If these relatively small differences within the same sibship can produce appreciable effects on intelligence-test scores, how much greater must be the influence of environmental differences within the wide range of conditions found at the extremes of our modern variegated society. Is it not possible that the differences between the average I.Q. of children at different social levels, and in families of different sizes, may be largely, or perhaps completely, accounted for by environment, without invoking any systematic hereditary stratification in average mental endowment?

One simple way of testing this possibility is to compare the observed differences of I.Q. at different social levels with those known to be produced by corresponding differences in environment. Burt gives a table showing that children of higher-professional men, at one end of the social scale, have an average I.Q. that is about 31 points higher than that of the children of casual workers, while there is a mean difference of about 16 points between children in the lower-professional and the semi-skilled grades. In a well-known study on identical twins, Newman, Freeman & Holzinger describe four pairs who had been reared apart since infancy in homes of different social levels corresponding roughly to the range between lower professional and semi-skilled. Any differences in I.Q. within the pairs must be ascribed to environment. In each case the twin with the better opportunities had a higher I.Q., the differences being 15, 17, 19 and 24 points, giving an average of about 19 points. In other pairs of twins where the disparities between the foster-homes were less marked, the differences in I.Q. were correspondingly smaller, but always in favour of the more fortunate twin. These twin studies are one piece of evidence among many that observed differences in I.Q. associated with social and economic status can be completely accounted for by effects of environment.

There is another way of approaching the question. Sir Cyril agrees that environment has some influence, but he regards it as of less importance than heredity. He quotes with approval the conclusion of Burks, that the contribution of heredity to the total variance in I.Q. is probably not far from 75 % or 80 %, which allows environment to claim about one-quarter of the variance. Although it is easy to show that the contribution of environment is underestimated, let us accept this figure, and ask, "What percentage of the total variance in intelligence is required to account for the difference in the average at different social levels?" Sir Cyril supplies the answer. He reports that the correlation between children's intelligence and social status amounts to

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## INTELLIGENCE AND THE BIRTHRATE

### A Reply to Dr. Woolf's Criticisms

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I am most grateful to the editor of the *British Medical Bulletin* for inviting me to reply to the interesting criticisms raised by Dr. B. Woolf. To deal in full with each of the five arguments advanced would need five long and technical discussions; and even these would be somewhat inconclusive, since the writer reveals only the results of his calculations, not the calculations themselves, or the methods on which they were based. However, somewhat similar contentions have been urged in the past by earlier writers, particularly in the USA, and have been discussed pretty fully in the literature. More recently Dr. Blackburn has criticized my pamphlet on much the same grounds; and both his arguments and my replies will be found in a forthcoming number of *Population Studies*.

May I begin by removing a few preliminary misconceptions? First of all, the general trend of the review may give an entirely misleading notion of my own conclusions to those who have read neither the pamphlet itself nor my previous publications. In my pamphlet, as was emphatically stated in the introductory summary and repeated once more in the concluding section, my chief aim was not to prove an alleged decline in national intelligence, but to plead for "systematically planned inquiries" into the whole problem. My reason was that "at almost every stage of the discussion the argument has been gravely hampered by serious weaknesses in the data". If, therefore, Dr. Woolf is seeking to show that there is no conclusive proof of any actual decline, he is merely reiterating what I myself had stressed.

Secondly, Dr. Woolf declares that "underlying all these computations" (namely, those carried out by Professor Godfrey Thomson, Dr. R. B. Cattell, as well as myself) "is the basic assumption that intelligence-test scores are completely determined by heredity". None of us made any such assumption. Indeed, Prof. Thomson and I went out of our way to disclaim it.

"Every psychologist", I said, "admits that the I.Q.'s furnished by intelligence tests, particularly when accepted without check or correction, may be influenced by schooling and other environmental differences". Thomson writes: "I do not think that environment explains more than a fraction—at most half—of the negative correlation observed" [between intelligence and family size].

Surely this is very different from assuming that the scores are completely determined by heredity. Dr. Woolf goes on to say that, even if we admit "verbally" that test-scores are influenced by environment, "this admission does not enter into [our] arithmetic". On the contrary, it enters both into our arithmetic and into the way in which I, at any rate, always attempted to test and correct the crude test-scores. In particular let me repeat that, in the main investigations to which he refers, the calculations were by no means based automatically on "intelligence-test scores" taken just as they came. Every effort was made to check the scores; and dubious cases were not only re-tested, but examined individually in various ways. As psychologist to the London County Council my work was not merely to survey schools by means of tests, but to decide so far as possible which of the dull, backward, or apparently-defective pupils owed their apparent shortcoming to innate and therefore irremediable defects, and which cases were remediable. In those early days both teachers and school medical officers were highly critical of so new-fangled a device as a psychological test of intelligence; and had my assessments been as faulty as Dr. Woolf supposes, there were plenty of sharp observers waiting to report any erroneous decisions. Moreover, an educational psychologist is concerned, not only with discovering cases of apparent backwardness, but also with attempts at remedial education. If, then, Dr. Woolf believes that our methods of assessing the innate intelligence of the dull or defective pupils are erroneously attributing to innate constitution what is really the effect of environmental handicaps, may I suggest that he join us in our efforts at improving the intellectual efficiency of these pupils, and point out to us where we have overlooked an environmental factor?

## INTELLIGENCE AND FERTILITY

*Continued from page 227*

0.32. A correlation of this size would use up only about 10% of the variance, out of the 25% which Burt allows for environment. Once again, the admitted influence of environment is more than sufficient to account for all the social disparities in the average of intelligence. There is no evidence of any genetic difference in mental potentiality at different social levels, and hence no reason to suppose that differential fertility can have any deleterious effect on the national stock.

There is no space here to review the evidence suggesting, though by no means proving, that national intelligence is rising. I hope to present this evidence, as well as the details of the calculations summarized in this review, in a series of papers in a more technical journal.

Sir Cyril Burt's plea for a census of national intelligence naturally has my full support. But a comparison of the mean I.Q. of

children in 1947 with that of a pre-war generation will prove nothing. If there has been a fall, the extreme eugenicist may ascribe it to heredity; but it might equally well be due to the fragmentary schooling and emotional upset of a generation of children subjected to bombing, evacuation, and absence of fathers on military service and mothers in munition factories.

The specialist will regret that Sir Cyril Burt does not make accessible the raw data on which his calculations are based, and that his references to his own previous publications are not always explicit. But although I regard his conclusions as altogether wrong, I nevertheless strongly commend Sir Cyril's pamphlet to the general reader as a sober contribution to a controversy of great public importance, and an ideal corrective of the dogmatism and sensationalism of so many of the advocates of national regeneration through sterilization of the lower orders.

Teachers and psychologists alike would welcome such assistance.

Thirdly, he declares that my conclusion is "based on extrapolation into the past and future from a series of tests all made at the same time". This again is misleading. The testing has been going on for nearly forty years; and in 1939 I was testing the children of parents who themselves had been examined as schoolchildren in or about the year 1914. Our more-comprehensive surveys were repeated at wide intervals. Dr. Woolf may still maintain that the comparisons are too fragmentary to be conclusive; if so, he shares an opinion which I myself expressed. But he cannot claim that my inferences about "the past" were based solely on "extrapolation". In his final paragraph, Dr. Woolf regrets that I have not "made accessible raw data on which my calculations are based". On the contrary, the "raw data" were carefully preserved, and were readily accessible to research students who desired to make use of them. Unfortunately Dr. Woolf himself has not so far made his own data or calculations accessible. He merely asks us to accept his own personal judgement that they disprove, and indeed reverse, the conclusions reached by most other psychologists who have worked on the problem.

May I now turn to his five main points? They fall into two groups. First, he complains that I did not introduce into my calculations certain corrections to allow for various subsidiary factors which he believes would wholly change the conclusions to be drawn. To these criticisms the general reply is the same. Every one of these factors was mentioned in my pamphlet. Further, as I there stated, I myself estimated the range and size of corrections, and found that they would not appreciably change the figures, and that in practically every instance, if made, would strengthen rather than weaken my case. The effects of such factors have been independently considered by such investigators as Godfrey Thomson and Fraser Roberts; and they too reached the same conclusion. Since, therefore, such corrections are always of very doubtful validity, it seemed far better to keep to the lower figures based on the data as they stood. Moreover, in a brief non-technical pamphlet it would scarcely be possible to digress on every page to explain and discuss the nature of the minor and somewhat speculative changes thus introduced. The second set of criticisms attributes to me "postulates" or "assumptions" which in point of fact I did not make (though they may have been made by earlier writers) and which I expressly disclaimed. But to these we shall come in a moment.

1. Dr. Woolf first points out that my simple method of assessing family-size, by taking figures for the number of children already born at the time of my inquiry, yields a reproduction-rate different from that generally accepted for the period in question. Actually the amount of the divergence (which the reviewer does not specify) is exceedingly small. It is true that, as I myself pointed out, it would be impossible to assume that the final size of each family had already been reached. But on an average the parents of the children with higher I.Q.'s are older than those of children of the same age with lower I.Q.'s, and therefore less likely to increase the size of the family. Hence, any correction for this, or any other "bias" in the estimates of family-size, would augment rather than diminish the effect with which I was concerned. Dr. Woolf roundly declares that, when corrections for "bias" are made, "the apparent decline in intelligence shrinks by nearly one half". But he does not tell us how he arrived at this surprising change.

2. A related source of error is said to consist in the fact that I made no allowance for the childlessness of certain adults. As I pointed out, the unmarried (unless they have illegitimate children), and married couples having no children, are necessarily excluded from such surveys. But I argued that these childless adults are likely to be far more numerous among the more-intellectual adults than among the less (consider, for example, the large number of unmarried female teachers). Dr. Woolf, however, considers that we have overlooked the fact that "only a very small proportion of imbeciles and virtually no idiots ever have children". He therefore is "inclined to believe" that the childlessness of the adults in these low mental grades would more than counterbalance that in the higher social classes; and infers that "the net effect would be an increase rather than a decline in the quality of successive generations". But the proportion of adults of imbecile- or idiot-level is less than 1 per thousand. Hence I fail to see how calculations based on actual figures could possibly support the reviewer's "belief".

3. Next, he says, "Burt postulates that the average size of family increases steadily with the declining intelligence of the parents". This postulate, he continues, is contrary to the established fact that parents below the borderline for mental deficiency show "a fall in the number of children". But I made no such "postulate". My statement was that, *on the data obtained*, the regression, "except where the lowest defectives are concerned, appears steady and linear". The figures to which he refers, showing a slightly irregular increase in average size of family, were not postulated figures, but observed averages. A more-detailed discussion of the evidence for the linearity of the regressions will be found in Dr. Fraser Roberts' analysis of the data obtained in the Bath survey—an investigation to which, curiously enough, the reviewer nowhere refers.

4. Dr. Woolf also "believes" that a genetic constitution making for very low intelligence is likely to favour abortion or early death. He admits that this would be "a very difficult thing to prove". There are, however, data relevant to the problem he thus raises; and it is hard to see how they could support the somewhat sweeping conclusion he draws. His main contention is that, in view of this alleged correlation, it is

"completely unsound to equate the average intelligence of a parental group with that of the fraction of their progeny who manage to survive the hazards of foetal life, birth, infancy and childhood".

The effects of differential mortality I have discussed elsewhere. But here the relevant reply is that I did not "equate the intelligence of a parental group with that of the surviving progeny". Admittedly, in previous inquiries, as I myself remarked, "most investigators have sought to deduce the average intelligence of the parental generation from the data obtained from the child generation"; and I added that such a procedure might easily evoke criticisms, like those now advanced by Dr. Woolf. Accordingly, my own procedure sought to avoid such objections by contrasting, not the level of the "parental group" with that of the children, but "the actual level and the possible level of the same generation". To estimate the effect of the differential fertility, therefore, I compared, not the "average intelligence of the parental group" with that of their children, but the average actually attained by the children with the average that would have been attained had fertility been the same in every family.

5. Dr. Woolf states that :

"In calculating the alleged decline in intelligence, Sir Cyril assumes that all the parents of mentally-defective children were themselves defectives, while all parents of scholarship children were of scholarship ability."

To begin with, as I have just observed, in the calculations to which Dr. Woolf refers, I myself made no assumption or inferences about the ability of the parents. But even those who did attempt to compare the two successive generations cannot be accused of the assumption which the reviewer suggests. He seems to imagine that, if in calculating a weighted average for a total population from the averages of its sub-classes the computer takes the average I.Q. of a given sub-class to be (say) 120, he thereby implies that *all* the members in that class have an I.Q. of precisely 120. Dr. Woolf goes on to quote my brief footnote on the correlation between intelligence and order of birth. He argues that this correlation would be "... quite enough to cancel completely the corrected apparent difference between parents and children." I cannot agree: it would be far too small. But once again to avoid this very type of criticism, I preferred (as I said in the footnote quoted) *not* to base my argument on an alleged "difference between parents and children".<sup>1</sup>

In his concluding paragraphs, Dr. Woolf suggests that "... the differences between the average I.Q. of children at different social levels ... may be largely, or perhaps completely, accounted for by environment ...". This is really a side-issue; but it is one that is frequently raised. Apparently he believes that, if we could only relieve the children coming from the lower social levels of their environmental handicaps, then these lowest levels would provide children with the same high average as is obtained from children of the professional classes. May I therefore ask him to accept this offer? Let him come with me to one of our better residential Homes, where children are received from their mothers very shortly after birth. Here an occasional boy or girl (usually the illegitimate child of a highly-intelligent father) may win a junior county scholarship, and even (in very rare cases) proceed to a University and obtain a first-class honours degree. If the poor I.Q.'s of the remainder can be "completely accounted for by environment," will he tell us how we can so improve the school and other environmental conditions that every child should do as well as these rare exceptional cases? Every teacher working in these handicapped areas would be only too grateful to the reviewer if he would tell them how to do it.

Finally, if the low intelligence discovered by the psychologist is due entirely to environmental handicaps, how is it that, when a strain of mental deficiency runs through the ancestry,

children from better social levels, living in the most favourable types of environment, still not infrequently show low I.Q.'s?

In support of this contention, Dr. Woolf refers to one of the many studies on identical twins—a study which Dr. Blackburn has also cited in his own paper elsewhere. Properly interpreted, the data do not in the least bear out his inference; but it would take too much space to discuss this line of argument here, and for a fuller examination of the matter I may perhaps refer to my reply to Dr. Blackburn.

Dr. Woolf ends this section by arguing that :

"There is no evidence of any genetic difference in mental potentiality at different social levels, and hence no reason to suppose that differential fertility can have any deleterious effect on the national stock."

That would suggest to the ordinary reader that my argument (like that of some earlier writers before the days of psychological surveys) was based exclusively on alleged differences in intelligence between various social classes. But in my pamphlet I went out of my way to emphasize that the differences to which I primarily referred were not differences *between* social classes, but differences *within* social classes.

He concludes his paper by saying that the plea for a census of national intelligence has his full support. But he adds that, even if such a census shows a decline in the mean I.Q. as compared with that of the pre-war generation, then

"it might equally well be due to the fragmentary schooling and emotional upset of a generation of children subjected to bombing, evacuation ..."

There have been plenty of investigations on the effects of bombing, evacuation, etc. There seems no question that it has certainly reduced the school-attainments of children who suffered in that way, but there is no evidence whatever to show that it has affected intelligence when properly tested and assessed. If, therefore, Dr. Woolf has really carried out investigations of his own which contradict this conclusion, he has omitted to quote them. But I rather suspect that this is one of those gratuitous guesses, so often made by "armchair critics" who have not themselves carried out any first-hand fieldwork of their own, and find it easy to forget investigations made by numerous other research-workers when they run counter to their preconceived opinions. Accordingly, until Dr. Woolf is able to give us, not merely a statement of what he personally is "inclined to believe", but also the details of the calculations to which he refers, it is scarcely possible to assess the precise importance of the objections he has raised. None of the investigators whose conclusions he wishes to reverse would deny that the difficulties he mentions undoubtedly exist. Indeed, they have been the first to draw attention to them. And I myself should hold that the main issues will have to be decided, not by criticism and counter-criticism, but (as I urged in my pamphlet) by more carefully-planned inquiries.

<sup>1</sup> Dr. Fraser Roberts has dealt with this point more fully in his article on "Birth order, maternal age, and intelligence" in the *British Journal of Psychology* (Statistical Section), 1947, 1, 35-51.

*The sudden death of Sir Joseph Barcroft on 21 March 1947 occurred shortly after the publication of the first volume of his Researches in prenatal life. Dr. A. St. G. Huggett, who is professor of physiology at St. Mary's Hospital Medical School, London University, has for many years been interested in prenatal physiology, and in the article below he reviews Barcroft's last publication and pays tribute to his influence on its subject*

## FUNCTIONAL EMBRYOLOGY

### Its Position and its Debt to Joseph Barcroft

Prof. A. St. G. HUGGETT

The problem of life before birth has always had a fascination for the human race, a fascination based partly on the mystical teachings of the great religions in which a non-biological hereditary tree has often been cited as their origin: an interest only paralleled by that of the post-mortem future. In both cases revelation has been rivalled by speculation as the source of information. In view of this, a very considerable amount of belief has centred in all ages upon inadequate factual data. Once again it is to Harvey that we owe the beginnings of our accurate knowledge.<sup>1</sup> His unrivalled capacity for accurate observation, coupled with the experimental approach, laid the foundations of the modern biological approach.

The chain of workers in this field from Harvey to Zuntz (1877) was often broken. The great burst of anatomical work in the nineteenth century led to the development of embryology, but almost entirely as a morphological science, in which functional inferences were made from the histological and anatomical configurations. It was however essential—understandably so—that topography should precede physiology. The names of His, von Spee, Turner, Minot, Hubrecht, Assheton, Hill and Jenkinson form the foundation of our knowledge of comparative embryological anatomy: they are continued in this century by Grosser and Mossman. The story took a big leap forward with the work of Zuntz and Preyer in 1877 who introduced caesarean section upon animals as a method of investigating function in the living mammalian foetus. Curiously enough, this was not adopted as an experimental procedure until 1923. The intervening years included experimental observations of Marshall on the reproductive cycle, and those on the developing egg associated very largely with the impulse given by Jacques Loeb and, later, with the classical experiments of Cunningham on the differential permeability of the foetal membranes. Parallel with this were the early histochemical observations of Hoffman, Goldman and Wislocki, which contributed much to our knowledge of the absorptive function of the trophoblast.

In 1923-27 the introduction at St. Thomas's Hospital of the technique of caesarean section in a saline bath at 37°C. enabled prolonged observations to be made on foetal and placental function under conditions of experimental leisure, and approximating to the condition *in utero*. In 1932 it was adopted by Barcroft and enabled his energy and drive to create the school of functional embryologists whose results over fifteen years are given in his *Researches in prenatal life*.<sup>2</sup>

Professor J. N. Langley, F.R.S., had died in 1926, at a ripe age while in office as Professor of Physiology at Cambridge. Barcroft was the first holder appointed under the rule of retirement at 65 years of age. On his retirement in 1937 he demonstrated that while a retiring age from active office might be desirable as a general rule, there were exceptions, and that he himself would illustrate this. When in his Chair, his immediate senior lecturer was Adrian. Each pursued his own researches, enlarging the body of knowledge in his respective field. In 1937 Adrian succeeded Barcroft in the Chair and the happy (but rare) symbiosis previously established was continued, and Barcroft pursued his work on foetal physiology in the same building in which he had worked all his life. The energy and drive possessed by Sir Joseph enabled him to build up, between 1932 and his death, a team of workers of ever-changing composition, but all united in enlarging and re-interpreting the body of knowledge on the placenta and foetus. The results are presented in this volume, which was to have been followed by at least one other, which Barcroft's sudden death on 21 March 1947 has prevented from ever being written.

Barcroft aimed at tracing the development of function in the mammalian foetus, as exemplified in the work of himself and his collaborators. The field covered includes certain basic anatomical considerations on the placenta and foetus, many of which have been brought to light by his colleague Donald Barron, now of Yale, and to whom he dedicated the book. Following this, he has collated the papers upon foetal growth and some dietetic considerations governing it, foetal blood-volume and placental blood-flow, the circulation in the chest and through the foetal heart, transfusion of gases across the placenta and their carriage in the foetal blood, and the nervous control of respiration, particularly at birth and immediately after. Eight appendices treat of certain ancillary aspects in which Barcroft frankly relied on the knowledge and experience of others.

There can be no question that the book forms a landmark in experimental physiology, a fitting successor to Preyer's volume on the physiology of the embryo in the last century. Previous to Barcroft's incursion into this field there had been relatively few experimental studies, and no systematic series. Our knowledge was based on histology, morphological embryology, clinical experiences and comparative anatomy and biochemistry. From 1932 to the moment of his death, Barcroft's experiments were designed as a sequence and a co-ordinated whole leading logically step by step to a body of tested knowledge. As a result of the work of Barcroft's team we have had to recast our views upon gaseous transfusion in the placenta, the mechanism of foetal carriage of oxygen in the blood, the mixing of blood in the heart, the role of the foetal nervous system and the existence of fructose in the blood. Most of all, we must approach all foetal

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<sup>1</sup> [For a recent assessment of Harvey's *Exercitationes de generatione animalium* see H. P. Bayon (1947) *J. Hist. Med.* 2, 51.—Ed.]

<sup>2</sup> [For particulars see *Book Reviews*.]



## THE EMBRYOLOGY OF BEHAVIOUR

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All over the world, students of human behaviour are happy to acknowledge their great debt to Arnold Gesell and his collaborators in the Yale Clinic of Child Development for their original, elegant and penetrative studies in the early development of individual human conduct. As I begin to write this review of his new work on *The embryology of behaviour*<sup>1</sup>, I have vividly in mind a recent visit to Yale. I recall with gratitude the courtesy with which I was met by Dr. Gesell, the beauty of the equipment and methods which he showed me, the intense scientific interest, whether for theory or practice, of many of his records, and the patience and insight with which he met the numerous questions of a deeply-attracted but certainly unspecialized enquirer after knowledge.

In my opinion this is one of his very best books, and that is to say a lot. In it he deals with those complicated and fundamental structures and functions of the human embryo upon which the whole behaviour of man as an individual organism with an independent existence is based. As one reads the story, unrolled here with remarkable economy and clarity of expression, one comes to realize more forcibly than would be possible in any other way, that there can be no real understanding of any form of human skill, bodily or

mental, apart from a knowledge of these very early developments.

The book has one outstanding character which distinguishes it from other major contributions to the same topic.

"We simply assume that as the soma takes shape," writes Gesell, "the psyche likewise takes shape. We are dealing with a single developmental morphology. The infant comes by his 'mind' in the same way that he comes by his body..."

It is the sustained attempt to show how everything which in later life comes to be regarded as volitional action has its basic preparation and gains much of its character from the first forty weeks of maturation, that gives the volume its appeal far beyond merely specialist circles. It is not that the highly-trained physiologist and anatomist are likely to find the account of small service. There is in fact no other published work in which the vast detail of experimentally-attested facts about prenatal human development are so comprehensively and at the same time so sparingly recorded. But every intelligent general student of medicine or of psychology, or, indeed, everybody who is intelligently interested in human conduct and its problems, can read it with understanding and great profit.

As already indicated the discussion draws freely upon an immense amount of specialized research. In particular, the outstanding cinema-studies of Davenport Hooker are very fully utilized both in description and in illustration. Also the related foetal studies of simpler organisms carried out by Gonzalez, Barcroft, Kuo, Carmichael, Coronios and especially Coghill are drawn upon.

Here, through picture and through word, we can follow the development, morphological and functional, of supine, prone, sleep-, facial, eye-and-hand and hand-and-foot behaviour of the foetal and the neonatal infant. We watch the emergence, disappearance, re-emergence and final establishment of the basic attitudinal reflexes, and see the specific patterns of interpretation and of movement growing out of them, with fluid and adaptive variations even before the exteroceptors are able to play their increasingly dominant roles. We see all the specialized structures being laid down

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<sup>1</sup> [For particulars see *Book Reviews*.]

## FUNCTIONAL EMBRYOLOGY

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placental problems in a new frame of mind. The importance of this book is that in one volume all the evidence of his work is presented as an orderly sequence. Over and above this, it is presented in such a clear and persuasive literary style that the simplest tyro can both follow the argument and observe the logic and the fallacies with ease. It is a pleasure to read, a pleasure enhanced by the work of the publishers.

Barcroft's death marks the end of an era in the physiology of the foetus. If he had lived it would have been extended no doubt, but he himself was moving it on to the next phase. This era extends from the early work of Zuntz to the present date, and can be described as the phase of observational physiology. In this phase has been accomplished for physiology the necessary description of the main processes which occur. Previous to this period, physiological knowledge of the embryo and foetus was largely based on anatomical knowledge and inferences from this. After the introduction of the saline-bath technique in the twenties of this century, physiological facts have accumulated rapidly—largely under the influence of Barcroft's drive, personality, and ability to see the essentials of a problem, to dissect it into its component parts, and to inspire workers in the British Isles, in Europe and in

America to tackle the several aspects so exposed. Simultaneously there have been three other lines of approach which are now converging in the new phase setting in. These are: the genetic approach; the endocrinological approach arising out of the study of the oestrus cycle and the development of the fertilized egg; and the obstetric approach arising out of the study of the nutrition of the foetus and the physiology of pregnancy, a study which has itself been fortified by the foetal work of the last twenty years. At the end of this phase we therefore have a fair knowledge of the physiological action of the foetus and placenta.

In the new phase we must look forward to a synthesis of all these lines of approach directed to the study of the peculiarly foetal problems of how function is initiated in the embryo and how it can be controlled. In fact, we may as a result be able to visualize the foetus not merely as a passive individual whose growth or development is outside our control, but as one whose care will be within our power as much as is an adult patient—so far as that is the case. The modern applications of biophysics must come into the field of experiment, to explain how the gene, the hormone, the vitamin, and the nutrient react with the mother to produce the newborn.

*Leprosy is a disease which has a fascinating history. In his article below, Sir Harold Scott reviews a new scholarly work by Professor H.-C. de Souza-Araujo on the history of leprosy in Brazil. Sir Harold, after a distinguished career in the Colonial Medical Service, became Director of the Bureau of Hygiene and Tropical Diseases which, among its valuable activities, publishes the Bulletin of Tropical Diseases and the Bulletin of Hygiene. Sir Harold is himself the author of a two-volume History of tropical medicine (1939) and has an unparalleled knowledge of the literature of so-called tropical diseases in several languages. His review is the product of an exceptional fund of learning and judgement*

## LEPROSY IN BRAZIL

SIR H. HAROLD SCOTT

Nearly twenty years ago Professor de Souza-Araujo, of the Oswaldo Cruz Institute, Rio de Janeiro, published his report<sup>1</sup> of a world-tour spent in the study of leprosy in 40 countries during the three years 1924-27. It was, and indeed remains, a work full of interest and replete with information of importance to all leprologists, but readers of it could not help being struck by surprising omissions, for no mention at all was made of the West Indies or of the South American States, countries in which leprosy is rife, and it seemed strange that these should be left out of a world-tour. One of these omissions is now made good by the appearance of the volume before us, the history of leprosy in Brazil.<sup>2</sup> It is a magnificent work and well worth waiting for. The position which the author holds allows him access to original documents and sources of information out of the reach of

most, and well has he availed himself of the privilege. In thoroughness and accuracy the work cannot be surpassed, for documents going back hundreds of years have been studied and all the points detailed in this volume are vouched for by *verbatim* quotations from the original sources, of which the authenticity is undoubted and of which many are reproduced in facsimile. The author's self-set task is not yet complete; the present volume, after a brief discussion of leprosy in pre-Colombian times, deals with leprosy in Brazil from 1500 A.D. to 1889; an account of the next sixty years will doubtless be issued later.

### Probable Pre-Colombian Freedom from Leprosy

The work opens with a discussion of the highest interest on the origin of leprosy in Brazil; was the disease indigenous or was infection primarily introduced from without? On the one hand we find Chico stating that the Spaniards saw many cases of leprosy when they first went to Mexico in 1519, and that, in his opinion, the disease had been imported from islands of the Sandwich Archipelago with which Mexico had been in touch from ancient times. Cortez, the Conquistador, also is said to have noted that cases were many, and to have actually founded a hospital for their isolation and treatment on the edge of Lake Texcoco, not far from Mexico City. Others have cited the mutilations depicted in old pottery as evidence that leprosy existed and was well known in olden times before there were written records. On the other hand, it is maintained that what has been interpreted as, and called, leprosy was in reality pinta (mal del pinto), now known to be a spirochaetal disease allied to syphilis, and that the facial mutilations depicted in pottery are those characteristic of espundia (a form of cutaneous leishmaniasis) rather than of leprosy.

It is always pleasant for a reviewer to find his theories confirmed by the independent researches of another, hence the gratification of reading that the author comes to the conclusion that leprosy probably did not exist among the aborigines of Brazil. Manoel da Nobrega (1549-60), in his work on diseases of that country, mentions none which could be interpreted as leprosy. Thevet, a Frenchman born in Angoulême in 1502, went to Brazil in 1555, mingled with the native tribes and noted their diseases; though well acquainted with leprosy from his previous travels he makes no reference to any such among the natives of Brazil. Anchieta, it is true, speaks of an individual attacked by a contagious disease resembling leprosy, but this is not worth much, for eleven years later he describes an outbreak of

<sup>1</sup> [De Souza-Araujo, H.-C. *Leprosy. Survey made in forty countries (1924-1927)* Rio de Janeiro, 1929.]

<sup>2</sup> [For particulars see *Book Reviews*.]

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so that when the time comes it is but a step, across a small threshold, to their effective use. We begin to appreciate, perhaps, more fully the significance of the very early development and perfection of the archaic motor-system, and to understand better the "unconscious" functioning of proprioceptors and interoceptors in later skilled action.

There is of course a thread of theory running through the whole presentation. Out of it all emerges a picture of the essentially anticipatory pattern of human behaviour. Not everybody will agree that the picture is correct, and many details certainly remain to be filled in, not all of which perhaps will be

found to fit very well. If ever Sir Joseph Barcroft's latest and most beautiful experiments on human foetal reactions come to publication, some of these details will become available.

Meanwhile the book is one to read, to re-read and to ponder carefully. It matters little whether everything that is said is to be accepted without modification. The story of development that is told decisively and clearly is not only fascinating in itself, but of tremendous importance for anybody who wishes to attain some measure of understanding of the manifold activities of human life.

smallpox in which "the body from head to foot is covered with a leprosy, like vagabond's disease, which might end fatally in three or four days." Anchieta came to Brazil from Teneriffe in 1553, lived among the natives for 44 years till his death in 1597, teaching them and treating the sick. Obviously the condition he described was not leprosy; this disease does not kill in three or four days and, if fatal in the same number of years, the course would be unusually short. If additional evidence is needed, we may cite De Lery and Soares de Souza of the XVI and Coreux, Piso de Liebstad among others of the XVII centuries, who describe yaws and other diseases, but never refer to leprosy as being indigenous; Piso goes even further and states definitely that leprosy was unknown there.

### Origins of Leprosy in Brazil

How then did the infection arise, for it became common enough later? Evidence points to two sources—Europe and Africa. First, to immigrants from Europe—Portugal, Spain, France and Holland. The Portuguese brought it to Brazil in 1496; incidentally, it may be mentioned that they were also responsible for its introduction into Madeira, an island free from it until their advent. Next, immigrants from Spain, then from France. Sailors from Normandy and Brittany often voyaged to Brazil and, according to De Lery, many settled there among the natives. There were some 750 leprosaria in France in the XV century, many of them in Brittany and Normandy. Lastly, Holland had many lepers in the XV and XVI centuries, several of them roaming mendicants, and emigration from Europe to Brazil increased greatly in the XVI century.

The European source was, however, a mere trickle compared with the torrent which followed as the slave-traffic from Africa became a thriving industry. Madeira and the Canary Islands were centres whence slaves were transhipped to Portugal and Spain and thence to the west, in particular Brazil. It would appear that to Jorge Lopes Bixorda belongs the odium of having started the slave-traffic to Brazil in 1538. The trade thrived apace, and a couple of centuries later a census gave the Brazilian population as  $3\frac{1}{4}$  million, of whom a little over 7% were indigenous, 31% were Europeans, and the remaining 62% were Africans, four-fifths of them slaves. Some authors—Juliano Moreira is perhaps the best known—have even gone so far as to say that the Africans were free from the disease until they acquired the infection from the Portuguese and Spaniards after being taken to Brazil. This, however, is protesting too much; all records show that Africa was the "first home" of leprosy—Africa, where today its endemicity is greatest. We may mention incidentally here that the Ebers papyrus (1550 B.C.) speaks of Uchedu or Chon's swellings, and the description of these resembles closely that of leprosy, and the records of Rameses II, two centuries later (1350 B.C.), point to the disease being present among negro slaves brought to Egypt from the Sudan. Brugsch in his *Histoire d'Egypte* (quoted by Hirsch) tells of the prevalence of leprosy in Egypt as long ago as 2400 B.C., in the reign of Husapti.

### Founding of Leprosaria

To return to Brazil: the greatest incidence occurred at ports where the slaves were disembarked and introduced into the country, and the districts in Africa whence they

were obtained for transshipment abroad were those in which the endemicity was highest. By the first half of the XVII century the prevalence was such as to cause alarm and Martim da Sá, Governor of Rio de Janeiro 1623-32, was the first to take up the question of a leper hospital. Varnhagen in his *History of Brazil* says that such an establishment was founded in 1637, but Professor de Souza-Araujo points out that this is erroneous and that 1637 was probably the date when the people appealed for control of the many lepers who were wandering about the towns unmolested. There may have been a "leper camp" in Salvador, Rio de Janeiro, about this time, the belief being based on legend to account for the existence of the Chapel of San Lázaro there. There has been considerable doubt regarding the first founding of a leprosarium in Brazil. People would complain and send memoranda to the Governors (the correspondence is reproduced in facsimile and one cannot help being impressed with the beautiful and clear calligraphy of those days, an outstanding lesson to modern writers, though the signatures are often partly obliterated by flourishes and ornamentation), who time after time postponed the issue by masterly inactivity, until in 1739 came a final demand for action based on the plea that there were "more than 400 infective lepers" in the town and that a site outside the town should be set aside for housing them. Instructions were given for the matter to be taken in hand without delay and thus came into existence the hospital at São Christovão.

In 1741, a Royal Commission sitting at Lisbon ruled that, as leprosy was contagious, all cases of the disease must be isolated, regardless of class and, with this end in view, they recommended the establishing of lazarettos with separate divisions for the sexes and for the different social classes, and compulsory notification (confidential for the well-to-do) giving the Medical Officers of Health authority over lepers, at the same time warning them of the possible confusion between leprosy and syphilis and of the need for careful examination of imported negroes.

On 31 January 1765, the Jesuit seminary of São Christovão was legally assigned for a leper hospital; the author reproduces a *verbatim* copy of the letter, or deed. At the time of its opening it could accommodate 100 patients, with separate sections for men and women and a central chapel. The place seemed almost ideal. It was by the sea, at an elevation exposing it to breezes from any direction, with a river of sweet water, a large space of level ground for agriculture, and pasturage for milch-cows. Accommodation was provided for the surgeon and his staff, for nurses, for slaves; a residence for the chaplain, a kitchen and a laundry. A copy of the statutes is reproduced defining the general discipline and the duties of the medical staff, nurses, accountants, etc. In January 1766 the patients of the Bobadella asylum were transferred to the new hospital.

Here let us leave Rio for the time and see what had been done in other Provinces of Brazil. *Pará*.—The first reference to be found of the existence of leprosy in the Lower Amazon is contemporaneous with its colonization by the Portuguese and the growth of slave importation. By 1804 it was becoming a social menace and request was made for erection of a hospital to house lepers. In 1816 one was founded in Belém. Vianna, writing nearly a century later, describes it as unhygienic and having none of the security and comfort which an establishment for housing infective persons should have. It was not walled, was not even hidden, but exposed, with many exits for the inmates; males and females lived together

"with the inevitable results." In *Pernambuco* the story is similar; extension of infection with slave introduction in the XVII century, becoming endemo-epidemic in the XVIII. In 1714 a leper asylum was opened in Recife, in the house of Father Antonio Manoel. This was taken over in 1761 for the Ursuline Sisters, and the lepers were transferred to a larger institute. A small establishment was known to exist in *Bahia* in the middle of the XVII century, in Salvador, and writers mention an old-established place for accommodating *morphoea* (an old synonym of leprosy) patients who had come from Africa and were roaming about the towns. In the Lisbon Archives, in the volume referring to Bahia 1757-1807, is a document regarding a leprosy campaign in that Province. It states that in 1757-8 there were countless lepers wandering unrestricted among the healthy in the towns, and the Viceroy was asked to sanction the erection of an asylum for them. When, later, it was proposed to send "scorbutic patients" (this disease went by the name *Mal de Loanda*), opposition was raised on the plea that the latter might contract leprosy. The hospital was actually opened on 21 August 1787, as is shown by a facsimile reproduction. Dates given by other writers are thus shown to be erroneous. In *São Paulo*, after considerable agitation and correspondence extending over many years regarding the isolation of lepers in various districts, the Hospital dos Lazaros da Chacara do Olaria was inaugurated in 1804, and patients began to be received there in March 1807. A census of lepers in the Province in 1820 recorded 564 among a population of 126,746 in twenty municipalities, or 4 per thousand. The disease would seem to have been endemic in *Minas Geraes* for a long time before an asylum was founded in 1771 in the Caraça Hills. In 1777 the renowned mulatto artist, Antonio Francisco Lisboa, son of the portuguese architect, Manoel Francisco Lisboa, and an african slave, Isabel, was found to be a leper. He was born on 29 August 1730, and was therefore now aged 47. He lived for another 37 years, dying at the age of 84, after suffering the pain, mutilation and loss of fingers and toes characteristic of leprosy of the mixed type. In 1816, a hospital for lepers was founded in Curabá, a town of *Matto Grosso*; a list of those concerned with its administration is given, and an order permitting certain officials to solicit alms on days of the month on which no Society was ordinarily allowed to beg for aid.

#### Care of Lepers in Rio de Janeiro in the Nineteenth Century

Returning to Rio de Janeiro. Everything seems to have gone well for many years, but early in the XIX century complaints were coming in, chiefly of the inadequacy of the water-supply, but on other counts also. Thus, part of the hospital grounds had been granted to a private person, Nicolau Vicini, for erection of a mill in 1809 and, three years later, more ground to Francisco Walis for a cloth-factory; there were also attempts to interfere with the administration. In 1814, of 182 beds 76 were occupied; of the patients 17 were Europeans, 38 negroes, and 21 half-castes — 40 less than in 1790. In 1816, owing to the need for housing the military, it was decided that the hospital should be taken over for barracks and a new home chosen for the lepers. The Ilha das Enxadas (Inchadas) was selected, but as early as 1818 complaints were made that the site was unsuitable and the water-supply inadequate. It is worthy of note that in this year, 1816, orders had been issued for

protection and aid for children of leper parents and for inspection of those boarded out, to guard against abuses.

The author has introduced a particularly interesting list of addenda to Chapters II-V, with copies of important, hitherto unpublished, documents from the Colonial Historical Archives at Lisbon, including the Proceedings of a Medical Conference held at Rio de Janeiro in May 1740, a minutely detailed plan for leprosy prophylaxis, an account of experiments, extending over a period of months, with a new drug from the plant *Sipó d'Onça*, and a reasoned report of the findings of the Commission upon it. It allayed irritation, and a decoction assisted removal of crusts, but it had no specific effect on the lesions. One item of particular interest is 25 pages of facsimile reproduction of Ravin's Dissertation on Leprosy and Vandelli's Memorial on the disease. The former is of historical value on the views of leprosy in the XVIII century and deals with the causation, symptoms, complications and treatment, with the author's remarks and a general discussion of the subject.

The third decade of the XIX century was noteworthy in the history of leprosy in Brazil. Here we find, in an official document dated 18 April 1822, the first mention of the idea that the infection might be transmitted by insects (mosquitoes).

Complaints became more persistent regarding the unsuitableness of Ilha das Inchadas as a site for the hospital; the soil was dry, water-supply inadequate, vegetation and milk lacking, so it was decided to transfer the hospital to yet another site, the Convent on the Ilha do Bom Jesus in the Bay of Guanabara, where it remained as the National (or Imperial) Hospital for the next decade or so, but not under happy conditions. Here, too, the water-supply proved very inadequate and unsuitable. It was by no means free from contamination, but was so charged with impurities that "it not only aggravated the terrible infection from which they all suffered (leprosy) but spread other grave diseases, for example, dysenteries refractory to all forms of treatment by medicine, constipation, chronic inflammation of the liver, and, finally, the cruel disease known as calculus, or stone, in the bladder; diseases which of themselves may be fatal." The administrators complained of difficulties in enforcing discipline, of patients absconding; inmates complained of ill-treatment and tyranny on the part of those in charge, of starvation, of deprivation of their dues, of diversion of patients' supplies to the Superintendent's family, of the setting of impossible tasks, neglect by the doctors, etc. The Memorial was sent to the Board unsigned, but it led to a surprise-visit and a thorough investigation. However, the verdict was that the patients' complaints were unfounded, and the inmates, when questioned, denied all knowledge of the Memorial. It was finally traced to a few unruly patients who, against all rules, used to break out to obtain alcoholic drinks, and would barter their food and clothing for forbidden articles. A company of veteran soldiers was sent, ostensibly to prevent patients from absconding, and the acts of insubordination promptly ceased. On another occasion, investigation of a complaint of neglect and ill-treatment resulted in dismissal of the surgeon.

By August 1832, the scheme of housing the lepers had run full circle when a final transference was made back to São Christovão. By a decree, the support of lepers by voluntary contribution was replaced by a Government grant for their maintenance. Naturally, the local residents protested against return of the lepers, but too late; the transfer had already taken place six months before the protest was sent.

Nevertheless the protest was brought up for discussion at a session of the Medical Society of Rio de Janeiro in March 1833. This Society has had a prosperous and honourable career, becoming later by Royal decree the Imperial Academy of Medicine. Its early publications appeared as the *Revista Médica Brasileira* and thereafter under various names, till in 1906 it became the *Boletim da Academia Nacional de Medicina*, a name which it still retains.

The resultant finding at the discussion on the protest was that no danger need be feared from the proximity of the lepers, that in Madeira the leper hospital was almost in the centre of the town, yet no ill effects resulted, whereas in São Christovão the hospital was some distance from the main residential part.

### Some Nineteenth Century Ideas on Treatment and Etiology

From 1830 onwards many discussions have taken place at meetings of the Society and papers dealing with the disease in question have been published in their journal. Some of these are given in detail in the volume under review and cannot, therefore, be passed over without notice. One, of much historical interest, is an article by Dr. de Meirelles written in June 1831, at a time when helminthology was in its infancy and the science of bacteriology a babe yet unborn, comparing and contrasting the two forms of elephantiasis, Graecorum and Arabum, and showing how they differed in course and termination. The author goes on to say that there are certain similarities between one or other of these and leprosy, but that to regard the last as a form of elephantiasis is quite wrong; that obscurity has resulted from looking upon all three as varieties of one disease; and that, owing to this confusion, much of the description of leprosy published previously had been "inexact, erroneous, or unintelligible."

Another paper records that a man suffering from leprosy was bitten by a "cobra cascavel" [a rattlesnake, *Crotalus terrificus*] and was completely cured of his disease in 15 days. This led another patient to allow himself deliberately to be bitten on the hand by one of these snakes. His symptoms, which are described, were typical, and death took place in 24 hours. In September 1839, other similar cases were discussed. The use of cashew preparations, an ointment and the resin, for some time a secret remedy in Maranhão, was the subject of another paper. Like most vaunted remedies for leprosy, this, too, failed to come up to expectations. Other forms of treatment which gained temporary prominence were hot baths, especially those of Santa Cruz, Goya Province, and of the River Pirapitinga. In addition to the hydropathic treatment, those with tubercles had local cautery applied with a hot iron. A paper on the method was delivered before the Imperial Academy of Medicine in June 1845, by Dr. J. M. Faivre. It is reproduced *in extenso* in this volume and is an interesting document; it gives the main chemical constituents of the waters, argues the question of benefit reported from their use and concludes that there are no real grounds for belief in their efficacy. Dr. Faivre adds that the thermal waters, by being deprived of oxygen and atmospheric air, may be the cause of the local prevalence of goitre.

Several points of importance are touched upon in the account of the last half-century of the period dealt with in

this volume. The leper hospital is now an excellent establishment, with hot and cold baths, a piped drinking-water supply and a steam laundry. In the first decade of this period a plant known as Assacú or Huassacú, *Ura* (or *Hura*) *brasiliensis*, one of the Euphorbiaceae, was gaining reputation in the treatment of this disease and, incidentally, of syphilis. A gummy, resinous substance was obtained by incising the cortex and it was used both internally and externally. Another remedy which has, contrary to the others, held its own was the *Carpotroche brasiliensis*, the Brazilian chaulmoogra. Photographs showing well the fruit, leaves and seeds are reproduced. Other papers and discussions held at the Rio de Janeiro Academy of Medicine are, some of them, sufficiently important to merit reference. The use of "Japéganga tea", an infusion of the root of *Quila japéganga*, one of the Liliaceae, had been tried in a desultory fashion for twelve years or so when in 1845 a plea was made for a more thorough testing of it. Dr. Faivre evidently enjoyed a sound reputation, for his paper on the thermal baths and another on morphoea (leprosy), summing up the knowledge of the time, were sent to the Governor. Morphoea was then often confused with syphilis, but was believed to result from "ingurgitation, inflammation and consequent disorganization of the tissues of the skin", or from eating pinhão (the Brazilian vomiting-nut) or the flesh of an animal (pig) which had fed on it. But leprosy existed where this plant was not found. In short, there were many "guesses at truth" as regards the etiology, and the conclusion was reached that leprosy was "an affection of an inflammatory nature of the capillaries of the skin", some maintaining that the capillaries involved were those of the blood, others those of the lymphatics—not a very satisfactory conclusion since the nerve-involvement was disregarded. Lastly, there is Dr. Paula Candido's monograph stressing the differences between syphilis and leprosy, discussing the etiology, especially possible dietetic causes, describing stages of the disease, surveying the treatment, and enumerating many vaunted remedies: galvanism, sudorifics, vasoconstrictors, arsenicals, mercurials, blisters, cautery, elixirs, reptilian poisons, and others—illustrating the old dictum that a disease with many treatments has no remedy. Prophylaxis, he says, "consists mainly in avoiding the things which cause the disease"—a safe guide but one not easy to follow at a time when the cause was not known.

\* \* \* \*

Much that is worthy of note has had, for lack of space, to be omitted from this review of a remarkable work. There is a brief bibliography of some special books and documents consulted, but many more records and reports had to be studied to enable the author to write this book. The index is full as regards actual page-references, but it would be of much greater value if these were amplified to save the reader searching for perhaps half-a-dozen or more references to find some particular fact.

Every worker in the tropics and, even more, anyone who is interested in the history of tropical medicine, will be grateful to Professor de Souza-Araujo, who is to be heartily congratulated on this achievement. The motto he has chosen at the beginning of his preface, *Feci quod potui, faciant meliora potentes*, is a happy one, but he need fear no rival.

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## BACTERIA IN THE KITCHEN

LAWRENCE P. GARROD M.D. F.R.C.P.

*Professor of Bacteriology  
University of London*

For good or ill, bacteria have much to do with food. The good they can do, if we include fungi, embraces the fermentations which produce wine, beer and vinegar, and the complex changes which give their distinctive flavour to many kinds of cheese. Their evil propensities are of two kinds—the simple spoiling of food by decomposition, and the production of specific forms of bacterial food-poisoning. How to prevent spoiling was known long before bacteria were recognized as its cause. All methods, whether ancient or modern, convert the food into a medium which will not support bacterial growth, or destroy the bacteria contained in it. Heat is almost the only agency which will achieve the second of these purposes: the first can be attained in many ways. One of these is drying, which has for long been used for meat of many kinds, more recently for milk, and only in the past few years for vegetables and eggs. An alternative is to raise the osmotic pressure to a point incompatible with bacterial growth: this can be achieved by either pickling in brine or by adding a high concentration of sugar as in jam-making. The use of cold is almost too familiar to need mention, but it is worth while to remember that this, too, simply prevents bacterial growth: so far from being lethal to most bacteria, it tends to prolong their life. Finally, chemical preservatives which act as antiseptics may be used: some of these, such as formaldehyde, are harmful, and their use is illegal: others, including boric, salicylic, sulphurous and benzoic acids are relatively harmless when used in limited amounts.

These are some of the matters dealt with by C. E. Dukes in a little textbook entitled *Bacteria in relation to domestic science*.<sup>1</sup> Bacteriology is now one of the subjects taken by students in Domestic Science and Household and Social Science, and this book tells them what they need to know of the general properties and distribution of bacteria, of their beneficent and destructive activities, and finally of specific forms of bacterial food-poisoning. It is written in a pleasing style, technical terms being either avoided or interpreted in simple language, and contains much material of interest to other kinds of reader than the students for whom it is primarily intended.

### Food-poisoning from Dried Egg

Dukes mentions duck's eggs as a possible source of *Salmonella* enteritis, but his book has appeared just too early to include a reference to a recent Medical Research

Council Report<sup>2</sup> on the transmission of such infections by dried-egg powder. The story told here goes back six years, to the time when it was decided to improve the British national dietary by the large-scale importation of dried egg from America. This was at first issued only to confectioners and caterers, but in July 1942 it was issued to the public. Only one month later, bacteriological examination revealed that some samples contained living organisms of the *Salmonella* group. A courageous decision was then taken about which the public and most of the medical profession knew nothing at the time: this was to continue importation, on the grounds that the benefit in nutrition outweighed the risks involved. Although the risk was proved by subsequent events to be genuine, this difficult decision will receive full approval in retrospect.

The Emergency Public Health Laboratory Service, as well as the Ministry of Food Laboratory, investigated this problem from every point of view during the latter part of the war, and this report contains the results of their work. That dried egg did cause a good deal of *Salmonella* enteritis is proved not only by the study of individual outbreaks, but by a survey of the incidence and bacteriology of the disease throughout the war-period. A rise in the apparent incidence in 1940 was almost certainly due to the establishment of the Emergency Public Health Laboratory Service itself, and the consequently improved facilities for diagnosis. A much more spectacular increase in 1942 signalized the advent of dried egg-powder as an item in the household ration. This merely circumstantial evidence is verified by examination of the species of *Salmonella* concerned: no less than 24 species appeared which had never been known to cause human infection in Britain before. These, of which the commonest were *oranienberg*, *montevideo*, *meleagridis*, *bareilly* and *anatum*, were also those most frequently found in samples of dried egg. These are also for the most part strains which have been found in the faeces of poultry in America. Alternative explanations, improbable as they may seem in view of these facts, are carefully considered. Among other branches of this investigation, a survey was made of the incidence of these infections in pigs in Britain, and many of the same new species were found, none of which had been isolated from pigs in a similar survey made by W. M. Scott shortly before the war. A secondary effect has evidently been to establish these new infections in our pig population.

It is clearly of the utmost practical interest to know in what circumstances these organisms can survive cooking. Scrambled egg, omelette and custard were prepared from samples known to contain *Salmonellas*, cooking times being carefully regulated and the temperature observed. In no case were the organisms recovered in culture after cooking, nor did they survive admixture with vinegar in preparing salad-dressing. On the other hand, when the egg was first "reconstituted" (i.e. mixed with water or milk) and incubated overnight before cooking, some of the organisms survived and multiplied again in the cooked product on standing. Survival seems therefore to depend chiefly on numbers: there are comparatively few in the dry product, but if they are enabled to multiply before cooking, the chance of survival is much greater. The effect of their multiplication after cooking was clearly illustrated in one outbreak resulting from the consumption of scrambled egg, when some of this food was set aside in warm weather and served again at a subsequent

<sup>1</sup> [For particulars see *Book Reviews*.]

<sup>2</sup> [For particulars see *Book Reviews*.]

meal, the partakers of which were the chief sufferers. The risk in using dried egg can therefore be minimized by preparing only as much of any dish from it as is needed for immediate consumption.

#### Ice cream

The potential dangers of ice cream have long been recognized, and were emphasized by the outbreak of typhoid fever at Aberystwyth last year caused by a carrier who was an ice-cream vendor. New regulations requiring the pasteurization of the mixture from which ice cream is prepared were made by the Ministry of Health at the end of last year. Those responsible for the supervision of this product will be interested in the new and simplified test for hygienic quality devised by the Public Health Laboratory Service and described in a recent report<sup>3</sup>. There has hitherto been no standard method of examining ice cream bacteriologically, although Compton & Youssef<sup>4</sup> and others have adapted for this purpose the total plate-count and coliform-count as formerly used for milk. The new method is an adaptation of the methylene-blue reduction test, and gives similar information about the extent of bacterial contamination by much simpler means.

#### The Flora of Food Utensils

Glass- and china-ware, spoons and other utensils in places of public refreshment can obviously act as vehicles of infection. This is of course recognized in hospitals, where the food utensils used by a patient with an infectious disease, whether a streptococcal sore throat, tuberculosis, or syphilis, are not only boiled after use, but kept for the use of that patient only. The examples mentioned were chosen because they are all conditions from which a person may be suffering and nevertheless visit a public restaurant. Many others might be mentioned, including dysentery and Vincent's infection. Anyone can see that the methods used for cleansing glasses and cups in some places of refreshment are quite inadequate and insanitary. This problem has been attacked with vigour in the USA, where mechanical dish-washing and the use of germicidal detergent solutions

or high-temperature drying are now fairly common. It has even been accepted that a properly "sanitized" utensil should not yield more than 100 bacteria of any kind on cultivation. Some indication of the progress being made in that country is given by the fact that three papers in a single recent issue of the *American Journal of Public Health* (April 1947) deal with this subject.

It is encouraging to see that Britain has not altogether forgotten this neglected aspect of public hygiene. R. Knox & Jacqueline Walker<sup>5</sup> made a study of the flora of large food-containers used in kitchens, with the idea that these vessels might be implicated in the spread of intestinal infections on a considerable scale in restaurants or factory-canteens. These vessels often contained large numbers of bacteria, and the numbers could be reduced to a harmless level either by steam-sterilization, or by thorough washing with soap or a detergent, wiping with a sterilized cloth, and finally rinsing with very hot water. R. Irene Hutchinson<sup>6</sup> presents much more alarming data, based on the cultivation of swabs from spoons, cups, forks, plates and glasses in use in hotels, restaurants, canteens and other places of refreshment, presumably of an average standard of cleanliness. Pathogenic or potentially-pathogenic bacteria were frequently found: they include various intestinal coliform bacilli, with one example of dysentery bacilli (Sonne type, from a spoon), *Staph. aureus* (coagulase-positive) and haemolytic streptococci (of several Lancefield groups, including one strain of group A from a fork). Samples of dish-washing water were sometimes found to contain as many as 1,000,000 living bacteria per ml., which is the approximate bacterial content of sewage. It is perhaps noteworthy that soap and other cleansing materials, towels and cloths are at present very scarce in England: these shortages may be a factor in rendering present conditions worse than they need be. But it is quite clear that the protection of the public in places of refreshment requires a radical change of method from the primitive rinsing and wiping which is still so common. No department of food-hygiene has been so neglected, and it is at least encouraging to read that the proprietors of the premises visited during this survey were interested, helpful, and "eager to know what measures could be adopted to remedy defects".

<sup>3</sup> *Mon. Bull. Minist. Hlth.* 1947, 6, 60

<sup>4</sup> *J. Hyg., Camb.* 1946, 44, 289

<sup>5</sup> *J. Hyg., Camb.* 1947, 45, 151

<sup>6</sup> *Brit. med. J.* 1947, 1, 134

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## CHEMOTHERAPY FOR EVERYMAN

### A Comparative Review of Three Recent Popular Books

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The increasing social importance of science—indeed, its now overwhelming importance—has impressed scientists with the urgent need for the results and implications of their work to be interpreted to the public. There is, however, no general agreement about the way in which this interpretation should be effected. At one extreme are those sticklers for precision who demand that works intended for the general public should be written by the scientific specialist, who should confine himself to his own limited branch of science. At the other end of the scale are those who proclaim themselves realists and state that to achieve the necessary wide circulation readability is the supreme need and that even scientific accuracy may to a considerable extent be sacrificed in achieving it. Both manifestly have reason on their side. While far more harm than good will be done by presenting to the public a distorted, inaccurate and incomplete view of science it is equally futile to provide scrupulously correct and polished accounts which are so heavy in style and content as to have a negligible circulation. Between these extremes are such alternatives as co-operation between a professional scientist and an experienced writer—open to all the objection of divided authorship—and the cultivation of science-writing as a profession, those who practise it being required to conform to prescribed scientific and literary standards. For providing the bulk of scientific reading-material to the public the properly-qualified professional science-writer is perhaps the best, if far from ideal, solution, though the scientific specialist who can make an occasional contribution to popular literature and the unqualified writer who will make an occasional excursion into the realm of science both have valuable parts to play.

The writer who attempts to interpret the results of medical research is in rather a difficult position. Although assured in advance of a wide circle of readers—for public interest in the functioning of the body in health and disease is considerable, even if sometimes rather morbid—very great care is needed in the treatment of the subject. On the one hand there is the fact that the full value of the proposed new public medical services, and of the existing ones, will be realized only with the co-operation of a public sufficiently well informed to appreciate the nature of the services available to them. On the other hand much harm may be done and misery caused by giving, accidentally or otherwise, false impressions about new methods of treatment and similar matters. This danger is, of course, particularly great in the case of diseases, such as cancer and tuberculosis, for which

existing forms of treatment are unsatisfactory. The false hopes raised and the bitter disillusionment caused by irresponsible writing on medical subjects are lamentable.

Three recent popular scientific books<sup>1</sup>, linked by the common theme of chemotherapy, form an interesting example of the different ways in which different kinds of author approach the subject. In *Molecules against microbes*, E. S. Duthie tells the story as a medical man who has first-hand and first-class knowledge of bacteria and the chemical agents available to destroy them within the body. He picks his way with certainty among the technicalities of the subject, and provides a clear answer to almost every question which the general reader might expect the text to deal with. Margaret Goldsmith, in *The road to penicillin*, deals with the subject from an essentially historical and literary point of view, avoiding technicalities, especially in the field of chemistry, with frank determination. The style and arrangement is, except in the last chapters, good and well calculated to arouse and maintain the interest of any intelligent reader. David Masters, in *Miracle drug*, relates the story of the discovery and development of penicillin—providing a certain amount of general discussion of chemotherapy as a necessary background—as seen by a practised journalist who has made a considerable, if not wholly successful, effort to get his facts right by consulting both the scientific literature and the pioneer research-workers concerned. His style is essentially dramatic. The text is punctuated by the frequent superlatives and overstatements which seem to be inseparable from popular journalism. However much this may be deplored by the literary stylist, there is some evidence that the general public likes the journalistic style and may indeed find it, if the emphasis is rightly laid, a valuable aid in picking out the essentials of the subject.

From the technical point of view *Molecules against microbes* is much the best of these three books. It is packed with information logically and clearly displayed according to a well-conceived scheme. The bacteriological and chemical background of the subject is thoroughly dealt with and the discovery, use, and limitations of almost every accepted chemotherapeutic agent are described. The chapter on penicillin is particularly interesting because of Dr. Duthie's own personal association with members of the Oxford research team. So far as the general reader is concerned, the chief criticism that can be made of the book is that it is too thorough, that the author has introduced factual material at the expense of readability. There is, however, no better introduction to chemotherapy available for those prepared to take a little trouble in ascertaining the essentials of the subject. Apart from being of value to the intelligent lay reader, the book should form a good introduction to chemotherapy for the medical student.

The main features of *The road to penicillin* have already been discussed. The historical treatment is excellent and the author has acquired the ability, invaluable to the popular writer, to sustain interest by the frequent introduction of unusual items of information. There is a good deal of verbatim quotation from contemporary writings, indicating considerable historical research. It is in the later chapters, dealing with the last century, that the author ventures on to less-certain ground. Her excursions into the technicalities of chemistry are not always happy ones, and she wisely refrains from making them more frequently than is absolutely

*Continued at foot of page 240*

<sup>1</sup> [For particulars see *Book Reviews*.]

*We publish below some impressions by a distinguished representative of Chinese medicine, written in the course of a visit as a guest of the British Council. The hope expressed by Dr. Chu, Dean of the National Medical College of Shanghai, for a strengthening of Sino-British medical relations will find a particularly strong response among those who have had the opportunity of appreciating the intellectual and personal qualities of Chinese colleagues. Dr. Chu's remarks are addressed particularly to British colleagues, but they are doubtless equally applicable to many other countries which have something to give to, and receive from, China*

## SOME THOUGHTS ON MEDICAL EDUCATION PROMPTED BY A VISIT TO BRITAIN

DR. H. P. CHU

During a period of about three months spent in Britain I visited London, Oxford, Liverpool, Edinburgh, Glasgow and St. Andrews. So hurried was the trip, that any observation I have made will necessarily be superficial and any comment on the medical education would seem premature at this moment. Concerning this subject, there is valuable information in the report of the Inter-departmental Committee on Medical Schools ("Goodenough Report", 1944). Views and opinions expressed there are largely based on the

evidence received from a large number of organizations and from individuals who are specially qualified to give helpful information and advice. It gives a comprehensive account of the conditions in various medical schools both before and during the war; it treats exhaustively of undergraduate and postgraduate training in respect of students, equipment, distribution and number of teaching medical centres, etc.; it offers suggestions and recommendations for the improvement of the British method of medical education. Though primarily written for the United Kingdom, in many ways it provides useful guidance also for us in China.

With regard to the teaching of pre-clinical sciences for example, it has pointed out that there is an urgent need in every school for a new viewpoint on the part of teachers of the preclinical subjects, and for the drastic elimination from the curriculum of a mass of detailed information which serves only to clutter up the student's mind and to deaden his interest in subjects that could and should be of the liveliest appeal to him. This may be exemplified by anatomy. The traditional method of teaching this subject is to let the student dissect a human body, and to commit to his memory a vast number of structural details.

Very much to the point is the remark made to me by Professor W. E. Le Gros Clark of Oxford, who said that dissection of the human body could be appreciably reduced, and that in routine teaching of topographical anatomy, form and structure should always be correlated with function.

In the Report some mention was made of social medicine. Its importance and scope is well summarized in the statement of the General Medical Council, which is quoted in the Report as follows: "The Council are of opinion that the study and teaching of Social and Preventive Medicine deserve further encouragement, in order that medical students and practitioners may be better acquainted with the influence of social, occupational, genetic, and domestic factors on the incidence of human disease and disability."

Oxford has an Institute of Social Medicine. Edinburgh and Glasgow place social medicine in the department of Public Health. What position it should occupy in medical

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essential. It might indeed be argued that even this minimum is not reached, and that for a book which sets out to give the history of chemotherapy the chemical treatment is far from adequate. Against this, however, it may be said that the general reader's knowledge of chemistry and chemical principles is so meagre that, unless an undue amount of space is given to their explanation, it is largely wasted effort to discuss them in any detail in a book of this kind. The last two chapters, describing the discovery and development of penicillin itself, are disappointing. Having travelled the long road to penicillin from the time of Hippocrates the reader might reasonably expect that particular care would be taken to ensure accuracy and balance in this last lap, but this is not the case. Dr. Chain, for example, than whom no one has done more to advance our knowledge of penicillin and whose services were recognized by a share with Florey and Fleming in a Nobel Prize, is scarcely mentioned. When he is mentioned he is submitted to the indignity of having his name constantly misspelt. Nevertheless this is a book which, taken as a whole, should convey to the general reader a good idea of the history of chemotherapy and the present possibilities and limitations of the method. It is very readable.

*Miracle drug* deals, as already mentioned, exclusively with penicillin. Although open to criticism from the literary and

factual point of view, it is, on the whole, one of the best popular books on penicillin that have yet been published. In particular, it is one of the few that give fair credit to the Oxford team, whose remarkable achievements are not yet fully appreciated even in Britain. All the essentials to an understanding of the discovery, development, manufacture, and use of penicillin will be found in this book. It is, however, embedded in a dense matrix of melodramatic and not always relevant material. Particularly aggravating is the technique—used by many other popular science writers—of putting conversation into the mouths of the principal characters. At this time it is obviously impossible to recall what was said in the course of casual conversation to which no particular significance then attached. Much of the conversation which is included in the book must therefore be purely fictitious, unconvincing, and quite valueless. Like *The road to penicillin*, this book has the important virtue of being readable, but it is likely that those who enjoy the emphatic, dramatic, journalistic treatment of David Masters will not like the much quieter and more scholarly approach of Margaret Goldsmith, and vice versa.

Although these books form a trilogy with chemotherapy as the common theme they cover different ground and approach the subject in so different a way that they are by no means mutually exclusive; all three can well be read with interest and profit.

curricula, time will tell, but that greater emphasis has been placed on the subject is quite apparent. In China, apart from the high rate of morbidity and mortality due to preventable diseases, there is an untold amount of suffering, misery and disability, which is often of our own creation, and to which we cannot close our eyes. It is only through the teaching and practice of social medicine that we could hope to find a solution of the problem.

The Goodenough Report has called attention to the salaries paid to teachers in pre-clinical and in clinical departments, and suggested that a national range of salaries with a lower and an upper limit be devised for each grade of teachers in the medical schools. We doubt if such provision would provide a complete solution of our problem in China. Time and again we have been disappointed by those who, holding full-time appointments, were loyal and devoted to the post at the time when they first joined the staff but, after a while, when enough contact had been made with patients, began to see patients privately in violation of the hospital rule. When warned for the offence, they simply resign and enter into whole-time practice. In the absence of an effective remedy to deal with such cases, the report is perhaps correct in saying that the vital matter is to appoint persons of the right outlook to the professorships.

So I could go on to dwell on many other points in the Report which are of concern to medical education in Britain as well as in China, but the mere repetition of them would be superfluous. It must suffice to say that it is a very valuable book for our reference.

After all, the standard of the medical profession in Britain is well guaranteed by the General Medical Council, the functions of which are to prevent the unfit from gaining access to the Medical Register and to remove the unworthy from it. In China there exists no such machinery. What we do is to grant a person a licence to practise medicine so long as he is graduated from a medical school that is registered with the government, and in standard there is considerable variation among the different schools. The most effective way of upholding the quality of medical education seems to us to subject all medical graduates, regardless of which schools they studied at, to an examination to be given by the Examination Yuan, the National Board of Examination. If this could be carried out, the poor schools would either have to improve or close.

During my stay in Britain, what has specially claimed my attention are the facilities for postgraduate training in medicine. To a Chinese student who is looking for an opportunity for advanced study, three alternatives are open: (i) house-appointment, (ii) research fellowship, and (iii) regular postgraduate course.

House-appointments are unlikely to be possible at present, since a large number of army doctors have been released from service, and they must make up time lost during the war.

By making an arrangement sufficiently in advance, one can usually obtain permission to work in a research laboratory where there are good supervision and guidance. There is no need to expect anything too elaborate in the way of equipment. As a matter of fact, of the laboratories which I have visited, very few are elaborately equipped but most are well provided with such auxiliary services as those of a mechanic's shop, glass-blowing and photographic departments, animal-houses, departmental libraries,

etc. These are rather vital to a research laboratory. Another point which impresses me is the teamwork in research, there being good co-operation between men of different specialities in a problem of common interest. The discovery of penicillin is a typical instance of the case. Nor does it matter if a student can make a discovery or not. So long as he has acquired the habit of learning by himself, and has learned the methods of approaching and executing a problem scientifically, we should not have to worry about him, because he can develop himself when he returns home.

The postgraduate course is generally very intensive and comprehensive. That in medicine, offered by the Edinburgh Postgraduate Board for Medicine, can act as an example. It lasts eleven weeks, and covers cardiology, respiratory diseases, alimentary diseases, haematology, psychological medicine, paediatrics and biochemistry in clinical medicine. Training of this kind would be valuable for a Chinese student, because when he goes home he may be called upon to attend a multiple variety of conditions in internal medicine in places where a specialist's services are not obtainable. In order to get the full benefit of the course, a student, before he comes, should have had an adequate amount of practical experience in a clinical field of medicine. In London there is the British Postgraduate Medical Federation which, apart from offering within its own area courses in general medicine, general surgery, obstetrics, pathology, diseases of children, laryngology and otology, neurology, ophthalmology and psychiatry, acts as a source of information on the postgraduate facilities available in the United Kingdom.

In China, before and during the war, there was a shortage of teachers in both pre-clinical and clinical fields, and the shortage is even greater now because existing schools are expanding and new schools being established. To such agencies as the British Council, Sino-British Cultural Association, ABMAC, the Rockefeller Foundation, etc., we are deeply indebted for the creation of many fellowships which enable Chinese medical graduates to carry on advanced study either in Britain or in the USA. Fellowship-winners are those who have passed a competitive examination in technical subjects, as well as in the English language. Fellowships are awarded to the best and most deserving. It is gratifying to know from various sources that the Fellows are doing hard and often admirable work and will be, we believe, the type of teachers required for our purpose. The results would seem to justify the expenditure.

While China is under heavy obligation to friends, American and British, for their assistance in training her medical and health personnel in the stage of rehabilitation, still no small amount of expense is involved in the maintenance of those fellowships. Furthermore, that only takes care of a limited number of those who need further training. Six or seven hundred doctors graduate in China each year. If they are left to their own plight, we are afraid that many of them would virtually degenerate into quackery, which from the educational stand-point is not only wasteful but harmful. What is needed is obviously a provision for postgraduate facilities at home in addition to fellowship-training abroad. At the moment, no ambitious scheme should be attempted, but every possible resource, governmental and private, missionary and non-missionary, should be made available for the purpose. The combination of

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## SHERRINGTON'S "THE ENDEAVOUR OF JEAN FERNEL"

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Those who have read Sir Charles Sherrington's fascinating Gifford Lectures, *Man on his nature*, will recall the attractive figure, therein painted with a loving pen, of Jean Fernel, the french physician of the Renaissance, the author of the first printed work on physiology, indeed the first work of its kind since Galen's famous "On the Use of Parts", and the actual coiner of the word "physiology". In his little and most charming work, *The endeavour of Jean Fernel*<sup>1</sup>, Sir Charles has returned to what is manifestly a favourite subject with him, has displayed his hero with sympathetic insight, and has created for his readers a vivid picture of the times and the intellectual climate in which Fernel strove to emancipate his thought from the animism which had hitherto so deeply coloured medicine.

Fernel may be said to represent Renaissance medicine shaking off its long association with astrology and magic, and slowly but surely groping its way to a place within the fold of natural philosophy. Yet the full emancipation of medicine had to wait yet another century until Harvey's great discovery, and his classic *De motu cordis*, had dispossessed medicine once and for all of the cardinal qualities, the humours and the temperaments, the elemental and the innate heats and the coctions, and all that animism which must have acted so potently against the unhampered use and

development of the method of observation. It was Harvey who set medicine and physiology upon the path they have since trodden so fruitfully. Fernel was but a precursor, but it is against the medicine of Fernel's age that we can see most clearly the magnitude of Harvey's achievement, which opened a gate to a world of biological science that we are still eagerly exploring.

Fernel lived between 1497 and 1558, and his career as a physician occupies approximately the last 30 years of this span. In seeking to trace the evolution of Fernel as a young master of arts in the University of Paris, through the period of his preoccupation with mathematics and with astrology, to his final emergence as a physician persuaded that man must be studied as a natural object and medicine as within the natural law, Sir Charles Sherrington has followed Plancy, Fernel's disciple and biographer, and from this and other sources has sought to depict briefly the intellectual background of contemporary life in the University of Paris against which the young Fernel developed.

It is perhaps peculiarly difficult for us in this age to possess a sympathetic insight into the intellectual climate of the Middle Ages, more difficult, indeed, for a scientist than for the historian, and therefore it is not altogether surprising if the distinguished author of this charming appreciation of Fernel tends unwittingly to enhance the merits of his subject by setting him against a somewhat darker background than full justice to the mediaeval world allows. It is not for nothing that the thirteenth has been called "the greatest of centuries," for it was the age in which scholastic philosophy achieved its full development, and the University of Paris was the shrine to which all mediaeval scholars turned. True it is that scholastic philosophy had lost its unity and was already far in decline by the end of the fifteenth century, when Fernel lived, but in dying it had left a rich legacy to the age of the Renaissance—a legacy not yet exhausted.

It is habitual with us in this age of "progress" with its technological wonders, technological barbarisms and barbarians, and its technological potentialities for yet more destruction and human misery, with its collapse of ethical sanctions and its social disintegration, to look somewhat patronisingly upon the Middle Ages, and to dispose of them in our minds as an age of logic-chopping and sterile disputation. Yet a modern philosopher and mathematician has reminded us of what we owe to that eminently rational age, before men had exchanged old lamps for new—a faith in Heaven and the angels for faith in science and the atom

<sup>1</sup> [For particulars see *Book Reviews*.]

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training both at home and abroad may in the course of time somewhat relieve the shortage of teachers.

Space does not permit me to write too long a story about my visit but before concluding, may I have the privilege to pass an opinion to our british medical colleagues. Though we are separated by distance and by differences in language, way of living, tradition, etc., we are nevertheless bound together by a common task in which you and I are engaged for the advancement of medical knowledge, for the protection and promotion of health and for the betterment of society. While you have already built a solid foundation in scientific medicine, we are only just laying the corner-stone; while you have already had such a number of doctors as would meet your need, we are still in serious shortage of them; while you have already caused many

of the infectious diseases to disappear from your country, they still constitute a serious menace to us. So many are our shortcomings that there is much that we shall learn from you and at the same time, we believe, there is also much in us, which would be of interest to you. Shall we not, beginning from today, bring ourselves into closer touch by establishing a channel through which ideas may be exchanged freely between us?

The above few lines represent a portion of my thought on the eve of my departure for home, and they also must serve to express my feeling of deep gratitude to those who have assisted in various ways to make my trip happy and profitable. Indeed there has been extended to me such an overwhelming hospitality that I do not know how I am going to repay it. I shall take home all these pleasant memories.

bomb—with who can guess how little increment in human happiness? In tracing the origins of modern science, Whitehead<sup>2</sup> points out that the Middle Ages formed one long training of the intellect of Western Europe.

"There may have been some deficiency in respect to practice," he writes, "but the idea never for a moment lost its grip. It was pre-eminently an epoch of orderly thought, rationalist through and through. The very anarchy quickened the sense for coherent system . . . It needs but a sentence to point out how the habit of definite thought was implanted in the European mind by the long dominance of scholastic logic and scholastic divinity. The habit remained after the philosophy had been repudiated, the priceless habit of looking for an exact point and of sticking to it when found. Galileo owes more to Aristotle than appears. He owes him his clear head and his analytic mind. I do not think that I have even yet brought out the greatest contribution of mediaevalism to the formation of the scientific movement. I mean the inexpugnable belief that every detailed occurrence can be correlated with its antecedents in a perfectly definite manner, exemplifying general principles. Without this belief the incredible labours of scientists would be without hope. . . . the faith in the possibility of science, generated antecedently to the development of modern scientific theory, is an unconscious derivative from mediaeval theology."

The foregoing is a lengthy passage to quote in what is no more than a brief appreciation of a biographical study, but it embodies truths so generally unknown to moderns, and so alien to our thought of the Middle Ages, that its full citation asks for no apology. Least of all, then, may scientists scorn the Middle Ages.

It is clear, however, from Plancy's account that the young Fernel had taken his M.A. degree at a time when the new humanist learning had not established itself in the University of Paris, and that Fernel himself was deeply aware of what he had missed, so aware that he turned back for another five years to classical study and to the grammar and rhetoric which, so Sir Charles Sherrington tells us, the new learning took so seriously, and not, as did the mediaevals, as "mere lessons in memorizing maxims for divinity". Yet surely,

grammar, rhetoric and logic formed the very foundation of the educational system of the mediaeval university, under the name of the Trivium. Their association was with philosophy and not with divinity or its maxims. They were the keen intellectual instruments of the coldly rational thought of the age. And rhetoric, that much abused term, was not merely "the art of persuading", but the art of the expansion and condensation of discourse by the use of metaphor and analogy. There is no good literature without rhetoric, and we who have in the psalms of the Authorized Version of the English Bible what is perhaps the loveliest and most uplifting rhetoric in any tongue do well to honour rhetoric.

The new learning could not indeed take grammar and rhetoric more seriously than did mediaeval learning at its best, and we can well do honour to Fernel and the Renaissance world in which he grew up without setting them against the synthetic background of a largely fictitious dark age. Indeed, it was perhaps as much from the medicine of the Renaissance as from that of the Middle Ages that Fernel sought to emancipate himself and medicine, and to bring the latter within the fold of natural philosophy.

In his account of this intellectual odyssey, Sir Charles writes with the insight of the scientific genius and humanist that he is, giving an intensely human picture of Fernel as thinker and as practising physician, and showing how the germ of the observational and inductive method grew in his mind so that finally he turned wholly away from his earlier pre-occupation with, and belief in, astrology, yet never succeeding in weaning himself from the animism of his day. Within the limits of this review I do not propose to summarize this story, for it is one every serious student of the history of medicine should read and contemplate for himself; but in conclusion it is impossible not to express a delight in the rich bibliographical knowledge displayed so modestly and aptly by the author. This little book has so plainly been a labour of love that the reader cannot but love it also, and with it the benign and learned sage who has written it for us.

<sup>2</sup> *Science and the modern world*, Cambridge, 1926.

## NUTRITION IN NEWFOUNDLAND

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University of London*

The nutrition of people in Newfoundland has attracted particular attention since Aykroyd, in 1930, reported on the incidence of beriberi and other deficiency diseases. Between 1941 and the end of 1944 three teams (McDevitt *et al.*, 1944, Metcalf *et al.*, 1945, Adamson *et al.*, 1945), equipped with the latest methods of investigation, visited the island. The population of one third of a million must be one of the most fully studied in the world. All three teams found evidence of widespread malnutrition, although they saw no cases of frank beriberi.

The last of these teams submitted a report to the Commissioner for Public Health and Welfare in the Newfoundland Government. In this report they recommended methods of improving the diet, safeguarding the nutrition of children, and teaching the people to make better use of the food available. It was considered that, as a preliminary step, ways and means of approaching the problem in the field should be discussed with a skilled and experienced nutritional scientist. The Medical Research Council agreed that Dr. Cuthbertson should visit Newfoundland for six weeks in the summer of 1945. In this time he visited the chief town of St. John's and both the interior and several of the outports on the Coast, held discussions with representatives of the Health Service, the medical profession and the Nutrition Council of the Newfoundland Government.

Although Cuthbertson went primarily to advise, he was able to examine 260 persons, mainly children, clinically. He found the signs of malnutrition, reported by previous investigators, but, apart from dental caries, the signs were less frequent. For example, in the most extensive survey of 1944 (Adamson *et al.*, 1945), mild follicular changes and follicular keratosis in 42% of subjects examined was reported, while Cuthbertson found those changes in only 15%.

Cuthbertson writes in his report<sup>1</sup>: "There is no doubt that observers differ quite markedly in their appreciation of what is and what is not a departure from normality." The significance of most of the clinical findings is very doubtful. Cuthbertson quotes Stannus (1945) who appears to consider that the "folliculosis", which the teams of the Ministry of Health have found in 15% to 35% of children, is the same as the follicular keratosis of, for example, Frazier & Hu (1931). But is this condition, which is so common in Britain, really like that illustrated by Frazier & Hu or the same as that found in Newfoundland? And, in the latter case, can the incidence in Newfoundland be regarded as evidence of

any special degree of malnutrition? Like his predecessors, Cuthbertson considered that the physique of the men was poor. Children were up to standard in height, but their weights were low. The heights and weights of a group of pupil-teachers compared favourably with those of men and women in Britain, belonging to comparable groups.

In the second survey (Metcalf *et al.*, 1945) the percentages of women and children with some degree of anaemia was considerably higher than those found in Britain in the 1943 survey (Haemoglobin Survey Committee, 1945). Even with such more-objective signs, it may be difficult to form any conclusion, owing to differences in the methods used in calculation or presentation of the results. Thus, in the report of the third survey (Adamson *et al.*, 1945), the haemoglobin levels of a mixed group of children and adults are compared with those of children, age and sex unspecified, in a school in New York; although a haemoglobin level that would be low for a man may be normal for a woman, and one that would be normal for a child of 7 years would be low for a boy of 15. The specific gravity of serum was estimated by the gradient method of Linderström-Lang; the concentration of protein was calculated by the formula of Moore & Van Slyke (1930), although this formula does not express the relation between concentration of protein and specific gravity as estimated by this method. There may be insuperable difficulties in standardizing the clinical methods; but agreement could be reached on laboratory methods and modes of expressing results. This might be one of the first tasks of WHO.

Cuthbertson recommends that the diet might be improved in the following ways:

*A. Milk.* Among the major needs is an increased supply of milk. All possible land should be cultivated. An improved type of grass, which would afford grazing early in the spring and late in the autumn might be sown. The use of silage should be taught. Possibly food-yeast, which might be made from the sulphate waste-liquors of the paper-pulp industry, might be used as a protein-concentrate. Enough milk could be made available, as a result of the reduction of demands by the navy and of the amounts used for ice-cream, to supply every schoolchild in St. John's with  $\frac{3}{4}$  pint [0.38 l.] of milk per day. Until the amount of milk produced locally is increased, skim milk should be imported.

*B. Vegetables.* Interest in gardens should be stimulated. Curly kale, which will withstand the winter, should be grown. Recommendations are made for storing during the winter.

*C. Animal Protein.* The people of Newfoundland eat that very dull fish, cod, and use other more palatable and nutritious species for manure. Their supply of animal protein could be raised by eating these other fish. Greater use should be made of cod-liver oil and fish-waste. It might be possible to restock the island with moose and caribou.

*D. Flour.* Methods of improving the quality of the flour are considered, and preference is given to the use of a flour of 78-80% extraction-rate, fortified with 0.5% bone-meal. Iron and synthetic riboflavin should be added, and food-yeast used. The inhabitants might object to 78-80% flour, as they despise any but perfectly white flour.

*E. Health education.* Educational campaigns should stress the value of milk and the need to improve cooking, particularly of vegetables. It is suggested that vegetables should be eaten raw, but while teeth are so bad this is out of the question.

<sup>1</sup> [For particulars see *Book Reviews*.]

# Annotations & News

1131

## WATER-SUPPLY

The importance of an adequate supply of water to any individual or community makes it surprising that the general literature on the subject is so scanty. In *The story of water supply*,<sup>1</sup> Mr. Robins has, however, produced a book full of erudition, showing evidence of wide travel and reading, with many illustrations, yet written for "the uninformed but interested laymen", which will for long be a standard work.

Water is mankind's most important and universal food, and it is natural that from the earliest times the development of human settlements should have been conditioned by the presence of an ample water-supply. Further, the recognition of the need that this supply had to be wholesome, within the limits of contemporary knowledge, led to the assumption that some divinity presided over the source. This ensured some degree of protection from casual pollution, and led eventually to the attribution of healing or magical qualities to many wells and springs.

Many of Mr. Robins' researches lead to interesting trains of thought. For example, it is sad to reflect that the inhabitants of Imperial Rome were supplied with wholesome water to the extent of forty gallons<sup>2</sup> per head per day, whereas this standard has once more become recognized as necessary only in recent times, and that the pump, widely used in the Roman Empire (there is an example at Silchester) fell out of use with the fall of Rome and was not re-introduced into Europe until the sixteenth century, and then mainly for the purpose of land-drainage. Again, although the slow sandfilter was not introduced until 1820 yet, in the seventeenth century, the citizens of Paris purified their drinking water, obtained from the Seine, by passing it through cisterns filled with sand.

Coming to more modern times, one is delighted to read that upon the inauguration in 1875 of a public water-supply at Trowbridge, the event was celebrated by sending a jet of water over the church-tower, but at the same time, one wonders what became of "Jinny Pumphandle" who presided for years over the older town pump.

To those of a modern generation who are accustomed to turn on a tap and to receive at once a plentiful gush of water, it must appear strange that most, if not all conduits, the main urban source of supply, during the XVI, XVII and XVIII centuries, were locked at night, while the Plymouth Dock Water Company in 1800 offered to its consumers a supply of water for two hours every second day.

Mr. Robins comments on the present practice of condemning any small well, supplying few people, whose water is not up to the standard expected by a large undertaking. He really answers his own question in a quotation he gives from Martin Lister, who wrote in the seventeenth century: "the water of the Seine is very pernicious to strangers . . . but the natives of Paris are not injured

by it". Consumers in a more static age became inured to the casual pollution of their own water-supply: when visitors were few, no-one suffered ill effects from its consumption. Further, the presence of pollution in a water-supply does not necessarily mean that the bacteria are pathogenic, but that if any one type of bacteria can gain access so too can any lethal one that happens to be in the neighbourhood.

The gradual deterioration of the water-supply of London during the eighteenth and early nineteenth centuries is discussed at some length, and might not the statement made in 1726 by the swiss traveller, de Saussure, that in London "absolutely no water is drunk. The lower classes, even the paupers, do not know what it is to quench their thirst with water" be answered by the reply of the witness quoted by the Report of the Royal Commission on the Water Supply of the Metropolis in 1834—"We cannot drink the water, sir, it makes us ill".

From this historical survey of water-supply, it is interesting to pass to a study of the Report,<sup>3</sup> published by the Department of Scientific and Industrial Research, of its Water Pollution Research Board.

In this report, the first to be published since 1939, the Chairman of the Board refers to the many problems, particularly those concerned with the disposal of sewage and trade-effluents, that have been referred to the Water Pollution Research Laboratory for advice. These problems arose during the war-years because camps, in great numbers, had to be set up all over Britain, and new factories, some with new industrial wastes, had to be erected on what would normally have been thought unsuitable sites. It is a matter of gratification that the Department was consulted so frequently on these problems and of satisfaction that helpful solutions were so frequently found. With future industrial developments and the establishment of new towns the knowledge and experience gained by the Department will become increasingly useful.

To show the diversity of the work undertaken it is necessary to mention only the elaborate investigation that was carried out into the nuisance caused by excessive fly-breeding on the percolating filters of sewage-works, when the wholesale destruction of the larvae would have ensured the destruction also of the scouring organisms, springtails and worms, which are needed to remove from the filter the biological film that would otherwise choke it. Promising results from the use of DDT and Gammexane have, however, already been obtained.

Important work was done which showed that creosote in an earth-closet acted almost solely as a deodorant, and that the use of caustic soda in a chemical closet had practically no effect in diminishing the amounts of organic matter in the final effluent, and certainly had no sterilizing effect on solid faecal matter: the final disposal of the contents requiring as much care as if they were untreated excreta. Of equal importance, though not necessarily of such universal interest, is the discovery that by means of aeration it is possible to keep the highly-polluting effluent from a flax-retting<sup>4</sup> factory at a pH value of about 7, and that it is then possible

<sup>1</sup> [For particulars see *Book Reviews*.]

<sup>2</sup> [1 gallon = 4.54 l.—Ed.]

<sup>3</sup> [For particulars see *Book Reviews*.]

<sup>4</sup> [Retting is a process for separating the fibres of flax from the woody part by soaking, macerating and other treatment.—Ed.]

## NUTRITION IN NEWFOUNDLAND

Continued from page 244

While food is so scarce throughout the world it may be correct to force marginal cultivation. Although it will be necessary to subsidize milk, and possibly other foodstuffs, if they are to come within the purchasing power of the local consumers, would it not be right for the islanders, when food becomes more plentiful, to give up an unequal battle with a harsh climate and barren soil and devote their labour to the production of those commodities which the island is specially fitted to produce? Some persons have

advocated the abandonment of the island but, as Cuthbertson writes, Newfoundland has a vital role to play in the world's need for animal protein. If they supply the world, the world should supply them with food that they cannot well produce at home. As the Hot Springs Conference declared, "the first cause of malnutrition is poverty". The islanders cannot afford to import what they need from abroad. At present both agriculture and fishing, like agriculture in peasant countries, are pursued in units that are too small. As Cuthbertson writes, if Newfoundland is to play its part in supplying the world, the entire fish-industry must be reorganized from top to bottom.

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for this fluid to be used many times for rets. Thus the quantity of final effluent is reduced to an amount that can easily be disposed of by spraying it on the land.

An important investigation into the effects of chlorinating the effluent from the Coventry sewage-works before its discharge into the River Avon had to be abandoned when it was discovered that the presence of a small amount of chlorine, considerably less than the chlorine demand, in the effluent, made this highly toxic. This is attributed to the combination of chlorine with thiocyanate, a regular constituent of an effluent composed, as so many are, partly of sewage and partly of effluent from gas works.

On questions dealing with the potability of drinking-water the Laboratory has been active. An investigation into the possibility of establishing a standard method of treatment for small supplies of lead-solvent water, usually from moorland sources, had to be abandoned owing to the war, but not before useful results had been obtained showing the value of finely-graded limestone-chippings from  $\frac{1}{8}$  to  $\frac{1}{16}$  of an inch<sup>6</sup> in size. But a simple method of removing the peaty film, deposited by the water on the chips, needs to be devised.

Owing to wartime shortages it was impossible to provide the elaborate aeration-plant necessary to enable certain iron-bearing waters to retain their iron in solution—if this iron comes out of solution the water becomes horrid in appearance and loathsome to taste and smell. It was found that the addition of sodium hexametaphosphate, in doses of about 2 parts per million, enables the bulk, if not all, of the iron to be retained in solution, and a considerable improvement in the potability of the water results.

One of the most useful and spectacular works carried out by the Department was the invention of a practical method of making seawater potable. This was of great value during the war, when sea-travel was hazardous, and many airmen were forced to abandon their craft in the sea and take to a rubber dinghy. For life-boats a still was designed, with a paraffin burner, from which it was estimated that a volume of drinking water ten times as great as the bulk of the paraffin, or 3.6 times as great as the bulk of the paraffin and still combined, could be made in a fortnight; the total amount of water per still being 60 gallons. For use in rubber dinghies, a chemical method of treatment was preferred, a method based on a silver compound of a base-exchange zeolite. When the zeolite was mixed with seawater, sodium was taken up by the zeolite, while the chlorine combined with the silver and was precipitated as silver chloride. The mixture was compressed into briquettes, to which a small amount of fuller's earth was added to help to break up the briquette when wet. As a result, an amount of drinking water 5.7 times the volume of the briquette was made available.

These are only a few examples, taken at random, from the Report. Much of the work has already been published in detail in scientific journals, and all is available to interested inquirers. The excellent results obtained show the value of a body with expert knowledge and reasonable facilities working, with considerable independence, under a grant from the Privy Council. Anyone may seek their advice, and this is freely and willingly given. In such a way scientific knowledge is used for the best purpose and for the direct benefit of the world. The discovery of such a multitude of practical and useful facts, and their application without let or hindrance whenever they are needed, shows science in its true perspective as a devoted and willing handmaid working towards the greater glory of mankind.

Amulree

<sup>6</sup> [1 inch = 2.54 cm.—Ed.]

## 1132

### ARE SYPHILIS, YAWS, BEJEL, AND PINTA MANIFESTATIONS OF AN ETIOLOGICALLY-IDENTICAL DISEASE?

*Treponematoses*,<sup>1</sup> by Ellis H. Hudson, is a work of the highest interest to syphilologists in any country and to all men practising in warm climates. It is most stimulating and indeed gives one furiously to think. If the author's views are accepted, and they seem very convincing, he, a man of wide renown in tropical medicine, has done good service in simplifying a complicated subject, in correlating and reducing to one fundamental cause four syndromes or symptom-complexes, namely those of yaws, syphilis, bejel and pinta, concerning the first two of which there have for years been conflicting opinions: the unicists, the protagonist of

whom was Admiral Butler, USN, maintaining that they are one and indivisible, and the dualists holding that they are separate and distinct. Etiologically—and causation is the safest ground for differentiating diseases—no distinction, morphological, serological or other, can be made between the treponemes found in all four. At the same time it must be remembered that the organism has not yet been cultivated artificially, and until it has we are justified in regarding them as one, and the symptoms produced as different manifestations of its activity, of treponematoses in short. It is wrong, and purely arbitrary to argue that because yaws and pinta are characterized by different symptoms, therefore the *Treponema* found in each, though apparently the same, must *ipso facto* be different. Cross-immunity experiments may help to solve the problem; it has been shown that syphilis seems to confer immunity to yaws, but the reverse of this has not, so far as the reviewer is aware, been tested,<sup>2</sup> nor whether pinta and bejel protect against syphilis.

Briefly, the author's thesis is this: In the moist tropics, treponematoses appears as yaws, a disease of the skin-surfaces, mainly of childhood, and non-venereal; in cooler and drier climates, as deserts and hill-districts, it affects normally the moist parts, axilla, fauces, perineum, vulva, forming mucous patches and again, mainly at least, non-venereal as bejel in Syria. In temperate climates, clothing covers most of the body and treponematoses is no longer primarily a skin affection but a mucosal one, and so passes from the juvenile non-venereal to the adult venereal form. Also, we see transitional treponematoses or "syphiloids" and "custom syphilis", in Russia for example, from promiscuous Easter kissing, kissing of ikons, and use of cups in common. All transitions between yaws on the one side and paresis (so-called parasyphilis) on the other can be traced. If yaws comes to a temperate climate it does not remain as yaws but as syphilis. The author gives an excellent and clear comparison between yaws, bejel and syphilis (pp. 64-67). The oft-repeated pathological differences between the forms of treponematoses are shown to be quantitative, not qualitative, "differences in degree, not in essence." Cutaneous dyschromia occurs not only in pinta, but in all the others. "It is one of the late hall-marks of the juvenile, untreated form of the infection."

Strains of an organism. *Treponema* or other, all can accept, but, asks the author, at what point does a strain become so differentiated from its fellows that it becomes a species? The difficulty is increased if there is the possibility of the new form slipping back to the original. Even granting that the different syndromes are caused by different strains of the same species, they are still merely variations of one disease. The author uses freely the term "clinical entity"—a term abhorred by Sir Clifford Allbutt—in spite of his defining an entity as "an independently existing thing." In the reviewer's opinion, syndrome, symptom-complex, or even symptomatology is preferable to an "independently existing thing" which cannot exist independently of a body—the patient—in which to exhibit and exert its effects.

We have abundant evidence that diseases may change their type. Scarlet fever, highly fatal less than a century ago, is now so mild that one hears a mother say "It was not scarlet fever at all, it was just scarlatina." Smallpox, even in epidemic form, in the tropics may be mild, as alastrim, or very severe and fatal. As the non-venereal type of treponematoses becomes the venereal, so the *sibbens* of Scotland, the *button-scurvy* of Ireland, the *radesyge* of Scandinavia and the *skerljevo* of Dalmatia show a reversal from the venereal to the non-venereal form, from syphilis-like to yaws-like.

To sum up: Yaws, bejel, pinta and syphilis are syndromes, not separate diseases, and even as syndromes they are not altogether distinct, but overlap. Fundamentally, that is etiologically, they are one; epidemiologically, as the result of environment and interaction between invader and invaded, they differ, and we can trace the progression from the earliest juvenile, non-venereal yaws, through the transitional, usually non-venereal, bejel and pinta to the adult venereal syphilis of civilization.

There are several other points one would like to discuss, but lack of space forbids. The work may be strongly recommended; the author has earned the thanks of a wide circle of readers and is to be heartily congratulated on the clarity of his exposition.

H. Harold Scott

<sup>1</sup> [In *British Medical Bulletin*, 1945, 3, 197, a report (BMB 772) was published of an original experiment by G. M. Findlay and R. R. Willcox. These workers succeeded in producing a penile lesion by inoculation with *Trep. pallidum* in a patient who had recently suffered from active tertiary yaws, and who possessed positive serological reactions due to the yaws infection.—Ed.]

<sup>2</sup> [For particulars see *Book Reviews*.]



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1133

# GRUNEBERG AND DARLINGTON ON GENETICS

Those of us who have one foot in genetics and the other in medicine have long been saddened by the knowledge that between these two fields of scientific enquiry there has in the past been far too little intercommunication. Whilst geneticists have been studying the action of the gene and the mode of inheritance of "characters" in their experimental animals of choice, those engaged in medical research have been seeking an understanding of the cause and of the mechanisms of development of human "disease", and quite commonly the character of the geneticist has been either very similar to or even identical with the disease of the medical investigator. So it is that, sometimes quite unknown to medicine, there has been accumulated in genetical literature a considerable volume of established fact which has a very direct bearing upon medical research and which, becoming known to the medical pathologist and clinician, would undoubtedly bring to him great reinforcement and a much greater understanding of his own problems.

Though, during recent years, the liaison between these two groups has been steadily improving, even yet medicine has been too little affected by genetical discovery. One reason for this has been that genetical enquiry in the main has until recently been dealing with the nature of the gene itself, rather than with the nature of its action upon the processes of development and degeneration.

Amongst those who have been most active in the field of physiological genetics is Hans Gruneberg, whose work has been so grievously interrupted by the circumstances of war. But even his wartime medical duties could not entirely satisfy his interests or consume his energies, for in 1943 there appeared a product of his pen, a magnificent volume on the genetics of the mouse, and now there appears his long-awaited book—*Animal genetics and medicine*—on the attractions which his own variety of genetics should have for medicine. With the appearance of this book there can no longer be any excuse for a lack of appreciation on the part of embryologists, pathologists and clinicians of the value of the contributions that genetics has to offer them. It sets out to evaluate inherited diseases as dynamic processes, and concerns itself almost entirely with the physiological channels by which the genes produce their end-results. The author shows in very brilliant fashion that the material of choice for the proper study of mankind is not always man, in whom genetic homogeneity can seldom be secured, who mates as he wishes, whose environment cannot be equalized, in whom inherited disease of the more obvious and simply-transmitted kind is rare, and in whom also the earlier stages of any pathological process cannot be intimately examined.

Dr. Gruneberg's argument, which he easily sustains, is that in a great variety of instances it would greatly advantage the pathologist and clinician interested in the etiology and manner of development in such a condition, for example, as harelip and cleft palate, to turn from man to the mouse, in whom this very condition is known to be a genetic character and simply inherited. The number of its exhibitors in the mouse can therefore be as numerous as investigation demands, since by appropriate matings any given number can be obtained; and since the mouse may be slain and examined at any point in its life-history, each and every stage in the development of this abnormality can be examined and recorded. What is true for harelip holds equally for a very large number of the more-puzzling and distressful abnormalities encountered in human medicine and which as genetical characters have been thoroughly studied—certain of the anaemias, endocrine disorders, locomotor disturbances and a great diversity of congenital and other defects and derangements which cover the whole range of the organs and organ-systems of man.

This book should have a very considerable effect upon developments in medical research, since in the storehouse of genetical literature there is a great mass of information which has a very direct and immediate bearing upon a very wide variety of medical problems. Though its production leaves something to be desired and its cost is high, it is a book which must not be disregarded by such as are seeking an understanding of the development of human anatomical and physiological abnormality.

\* [For particulars see *Book Reviews*.]

We in Britain have been singularly fortunate in that genetics has always attracted some of the best minds in biological science. At the turn of the century there was Bateson, a very great figure, and from him there sprang a line which has always succeeded in maintaining the great reputation of British geneticists. J. B. S. Haldane, R. A. Fisher and C. D. Darlington are names which, like that of Bateson himself, have become woven into the very fabric of genetical science. They are but few compared with the geneticists of like ability who have enjoyed so much greater opportunities in the United States of America, but the importance of the contributions that they have made to the development of genetical theory is not surpassed.

Darlington's *The evolution of genetic systems*, first published in 1939 and now reprinted<sup>2</sup>, shows the great quality of Darlington's mind. Cultured, well stored with scientific fact, using fact as an invitation to thought and adventurous speculation, bold, somewhat aloof, imaginative beyond the ordinary, iconoclastic, perhaps finding a certain pleasure as it soars in flight in disregarding the criticisms of such as insist on keeping their feet well sunk in the mud of current orthodoxy, it has predicted time and time again that which later the critic himself has reluctantly found to be so.

An irritating person this, who because of his stature can see what to the rest of us remains hidden. To be so often right is to attract both praise and abuse, and Darlington has received a great deal of both—not that either has bothered him or caused him to pause as he has proceeded to construct his hypotheses.

This book of his is one of the outstanding contributions to biological synthesis that has appeared during the last hundred years. It is a small book, for Darlington does not waste words, but it is crammed with arguments and ideas; ideas that are of the greatest importance in that they corrode the barriers between the several compartments of biological science—even between the physical and biological sciences.

It is no book to read at all easily; it is one to be studied closely, and it merits the most careful study. It is recommended that it should be approached with the intention of disagreeing with almost everything it says. But the reader must be warned that, if fairness is maintained, it will be exceedingly difficult to end it and still find that one remains unconvinced as to the essential reasonableness of it all.

Admirable is the man who can cultivate such ideas and present them in such fashion.

F. A. E. Crew

1134

# PROGRESS IN THE WAR AGAINST THE LOUSE

The literature concerning the arthropods parasitizing man is widely scattered in numerous scientific journals, not necessarily medical, and written in many languages, while the more important the parasite and the more widespread its distribution, the more extensive become the records of those who have studied its bionomics and control. Under certain circumstances one or more of these parasites may assume, quite suddenly, special importance, in which case it becomes not merely desirable, but essential that some scientist, whose training and knowledge have specially fitted him for the work, should undertake the onerous task of sifting the existing knowledge of the subject and presenting the results to those responsible for applying it to the best advantage. In past wars the louse, in its capacity as a vector of epidemic disease, has always assumed a position of great and sometimes of predominant importance, and hence the opportune appearance of Professor Buxton's book on *The louse* at the outbreak of the recent war. A reviewer of the first edition wrote in 1939,

"The war of 1914-18 called forth in all countries an immense output of research on the louse—its biology and the best means of combating it under war conditions. The 20 years which followed, although they have added much to our knowledge of the louse-borne diseases, have added almost nothing to the efficacy of existing methods of louse control. With the renewed outbreak of war the louse will again become a military problem—how important a problem will depend upon which of the louse-borne diseases make their appearance among the troops."

To that might be added: and in how short a space of time we can augment our existing scanty knowledge of louse-control! That this essential knowledge was forthcoming in time to prevent any serious outbreak of louse-borne disease amongst British or

\* [For particulars see *Book Reviews*.]

american troops on any battle-front is now a matter of medical history and justifies the author's comment, in a recently-published 2nd edition<sup>1</sup> of his book:

"The efficiency of DDT in controlling body and head lice, even under extremely bad general conditions, is so great that perhaps we have now seen the last great typhus epidemic."

This is a fine achievement and one to which the author of the book has contributed no small share. As a result of this advance in knowledge during the war years, Buxton's book has grown from 145 to 164 pages, each of which contains considerably more type than did the first edition, and the chapter entitled "The control of lice" has had to be completely re-written, "... for what was said in the first edition has now nothing more than historic interest"; while the section devoted to the collective biology of the louse has also been considerably expanded. The 1947 edition is printed on considerably thinner paper than that of 1939, so that the increase in print has caused no corresponding increase in bulk, indeed, the new edition is a more slender volume.

The amount of work involved in writing this book and in bringing it up to date must have been great, but the result is worth while and may encourage others to do for, let us say, the bed-bug, what Buxton has done for the louse and Heilesen for the itch-mite.

R. M. Gordon

<sup>1</sup> [For particulars see *Book Reviews*.]

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## A NEW KIND OF MEDICAL TEXTBOOK

Dr. A. E. Clark-Kennedy's *Medicine*<sup>1</sup> (Vol. I, *The patient and his disease*) is not just "another text-book of medicine". Its author is alive to the defects of existing manuals and seeks to provide the remedy. The rapid growth of medicine and of its complicated techniques of diagnosis and treatment have determined the shape of present-day clinical instruction. The student is taught by experts in a limited field; patients are too often segregated in hospital into groups according to the principal site of their disease (e.g. heart departments), or to functional disturbances (e.g. allergic and diabetic clinics), or to the form of treatment proposed (e.g. medical and surgical wards). Modern text-books reflect this compartmentalism. They assemble contributions from many sources, excellent in themselves but lacking correlation and integration. Notions of "disease" which are equally applicable to, say, peritonitis and meningitis are unheeded or disregarded; instead the writers provide detailed descriptions of "diseases", unmindful that a convenient label is a flimsy foundation for rational understanding. Thus, for the student, medicine comes to resemble a patchwork quilt with many gaps when what he needs is a tapestry of continuous, clear and purposeful design. For he must study man as a whole, as a sentient being who is more than the sum of his parts.

The aim of this book is to correct the faults of a fragmented medicine, to emphasize the general principles which underlie the phenomena of disease, and to describe the elements of the methods of medicine as a foundation on which to build securely as knowledge grows and experience deepens.

The first volume treats of *The patient and his disease*. It opens with a chapter on Body and Mind, in which is attempted a synthesis of the basic preclinical sciences which Dr. Clark-Kennedy rightly holds to be an indispensable introduction to clinical medicine. This is perhaps the least-successful chapter in the book. It is not possible to compress so much into the space which the author permits himself for the statement of this part of his thesis. The second chapter deals with Symptoms. In it is emphasized the imperceptible transition between health and disease, and how artificial is the separation of symptoms and signs. Here also are described the methods by which a patient's complaints, both mental and physical, are elicited, and how they are to be interpreted in terms of disordered function, structure and mind. Fatigue—mental and physical—pain, indigestion, shortness of breath, fever, flatulence, repeated vomiting, giddiness, faints and fits, chronic constipation and diarrhoea, gain and loss of weight, bleeding and other discharges from the body's orifices, are among the examples quoted to show that symptoms and signs arise from derangement of normal physiological mechanisms; their causes are illustrated from all branches of medicine. In the third chapter the information which a detailed physical examination reveals is subjected to similar analysis.

<sup>1</sup> [For particulars see *Book Reviews*.]

The fourth chapter is an admirable essay on the influence on man's life (and death) of Heredity and Environment. It will surprise the orthodox to find a description of intrauterine development in a textbook of medicine, but if human life and its ills are to be reviewed and a continuous story unfolded, the start is in the fertilization of the ovum and the end is in the grave. The interplay of nature and nurture is reviewed in assessing the effects of nutrition, accidents, chemical substances and other forms of life on the genesis of disease; and their influence on such diverse features as a man's personality, philosophy, religion, deformities, ageing, degenerations, neoplasms and the rest, is reviewed.

There follows in chapter V a description of mental and bodily reactions, both physiological and pathological, to changing demands and altered environment. Physiological adjustments, hypertrophy and atrophy, inflammation and allergy, anxiety and fear, escape-mechanisms and self-deception are but a few of the reactions examined. The final chapter attempts to define the Nature of Disease. It embodies the author's thesis: "Pathology is the study of the interaction between the genetic endowment of man, his way of life, and the environment into which he has been born. There is a pathology of the body and a pathology of the mind. Each has inevitable repercussions on the other... A pathological process of the body is the action of some factor which exerts an adverse influence directly on or in the body and the natural reaction by the body. Some pathological processes arise from defects in the genetic plan whence the individual is derived. Others arise as the result of life in the environment." The seven pathological processes which he recognizes are congenital defects, nutritional failure, trauma, chemical poisoning, infection, neoplasm and degeneration. All these are of the same physico-chemical nature as the body. Disease represents disturbances at the level of the body's physico-chemical reactions, though it may also start at the metaphysical level of the mind.

It would be idle to claim that Dr. Clark-Kennedy's thesis is here adequately summarized. It does not easily lend itself to compression. Indeed, if there be any valid criticism of this work it is that its author has crammed too much into too small a compass. Some of his statements are so condensed as to be misleading. His explanation of visceral pain (p. 65) is inadequate and outmoded. Does colonic pain "travel round the abdomen"? And does cardiac pain "compel the patient to stand still under almost any circumstances" (p. 66)? Would many agree that: "Gall-stone dyspepsia is probably a myth" (p. 71)? Will the novice profit from the "potted" version of philosophy and religion on pp. 219-223? But it is ungracious to raise minor and immaterial points of criticism for here is a most thoughtful and scholarly work, written in an engaging, vivid style, which presents the philosophy of medicine with exhilarating freshness. It will not yet supersede the standard textbooks of medicine for there are still examinations to pass. But the attitude of mind which this book seeks to inculcate will endure when many of the "facts" of medicine are forgotten. To the senior student and to the practitioner it can be recommended without reserve. A second volume on *Diagnosis, Prevention and Treatment* is promised shortly.

Henry Cohen

1136

## DESPOTISM IN THE FAMILY

In a small book<sup>1</sup> on *The psychology of the unwanted child*, Dr. Agatha Bowley deals with great themes. Her aim is to reach the minds and to influence the practice of all those who are placed in charge of outcast children, so that these new guardians may "... recognise the supreme interest and importance of their task..." She is well fitted by her writings, study and practical experience, to offer advice of this kind. Although aware of the complexity of the subject, she tries in this book to give her readers practical suggestions and simple explanations.

In the first two chapters she deals first with the essentials of a good home where there is a right personal relationship between the parents and the children; and then with the disastrous effects of parental neglect on the personality of the child. These two chapters are a brief, fragmentary, and rather unsatisfactory analysis of the happy and the unhappy family. On this preliminary background there is drawn, in greater detail and with interesting documentation from her own studies, the picture of the unwanted child, often already showing deep marks of injury in character and

<sup>1</sup> [For particulars see *Book Reviews*.]

behaviour; and of the problem of re-adjustment of the child in the substitute-home, whether adopted, boarded-out, or in institutions.

The psychology of the child, whether with steady or with shaken personality, is a vast and profound subject; and the science of this dark continent of child-psychology is itself in its infancy, not yet sure or clear in its language, nor equipped with authoritative and accepted doctrines. But the exploration of the child-mind is being steadily pursued by scientific methods, and much new knowledge has been won. Under the surface of child-behaviour, the motives and meanings of this behaviour have been disclosed in child-play and dreams, and by other methods of investigation; and this understanding of hidden motives has given many clues for treatment and re-adjustment.

But the deeper mysteries of the influences that pass to and fro between mother, father, and children are the primary causes that shape the developing personality of the child; and these mysterious currents of influence require much more study and clearer enunciation. Those deep and obscure forces that determine the happy or unhappy destiny of children are only briefly mentioned and glanced at in the book. This is not put forward as a fault or criticism in a book which has more immediate and practical aims; but it is a warning against too hasty and confident application of unproved theories and speculations to clinical practice.

In fact, this little book raises, although not dealing fully with them, the ultimate issues of human welfare and happiness—issues that are being continuously decided all over the world in all the families of mankind. Neither can these great issues be properly discussed in this review; but a brief and scrappy final comment may be made. The present wide-spread dissolution and destruction of human families which shows itself in many ways, and especially in the increasing numbers of unwanted, uprooted, and "displaced children", has many causes. What we are witnessing today in so many of our families of every class, is, in social and political terms, a condition of civil anarchy in the family. This anarchy is due in part to the breakdown of the principle of monarchy in the family "state". Monarchy in the family is the strict unquestioned rule of parents (mother and father) over the child; and the little child thrives best in the air of despotism. Without this loving despotism of the parents, the child turns towards spiritual anarchism, becoming a law unto himself, and missing the two primary "goods" of human life—control of self and consideration of others. But today despotism is a hated word, and discipline is out of favour. The monarchical principle in family life does not seem to be favoured by Dr. Agatha Bowley, and in her explanations of causes and remedies little mention is made of strict rule and discipline in the family.

psychology. "If the acrimonious discussion and misunderstanding which has existed in the past is to be avoided in the future, it is of the greatest importance that the limited nature of the deductions which can be legitimately made about the colour perception mechanism from colour matching data, should be recognised."

Perhaps he clings to this opinion too rigidly, since a little more speculative interpretation of his results would have done much to lighten an otherwise commendable detail and precision in their statement.

By way of contrast, Dr. E. N. Willmer's *Retinal structure and colour vision*<sup>2</sup> seems to strike an admirable balance between fact and theory. He puts forward a new interpretation of existing data on the physiology of colour-vision and shows a delightful ability to use a theory to its best advantage without becoming blind to its deficiencies. He is deliberately speculative for he believes that "... the purpose of a hypothesis is to stimulate thought and research, not necessarily to be right in the first instance."

It has become almost a tradition in visual physiology to postulate four different types of light-sensitive receptor in the human retina—the rods, operative only at low intensities, together with three types of cone each peculiarly sensitive to bright light of either a red, blue or green colour. Dr. Willmer, as a histologist, re-examines the data in support of such a hypothesis and concludes that "... an undue weight must not be placed on the negative histological evidence, but at the same time the evidence is negative and that in spite of over a century of research directed towards the demonstration of different cone types."

He shows that the two well-known visibility-curves for the light-adapted and dark-adapted eyes are sufficient, with certain reasonable assumptions, to explain many of the accepted data on colour-mixing. These two visibility-curves are usually regarded as representative of the individual rod- and cone-sensitivities. This leads him to the main theme of his book, which is an admirably-balanced discussion of how far the existence of two functionally-different receptors, the rods and cones alone, will go towards explaining the known facts of colour-vision. The investigation certainly "... provides for the first time, an opportunity for describing many of the phenomena of colour-vision in a quantitative manner, which is at the same time related to the physiological basis of vision." After an almost spectacular success with his original hypothesis, he is ultimately forced to postulate a third type of receptor-cell, with maximal sensitivity to blue light, which although a rod, is unable to adapt itself to darkness.

Whether or not all of the assumptions made in this book stand the test of time and further experiment, seems less important than the fact that they are bound to give new vitality to a subject which at times seemed badly in need of some such medicine.

<sup>2</sup> [For particulars see *Book Reviews*.]

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## COLOUR-VISION

Two recent books on colour-vision report their authors' original work and theories, presented in a general review of the subject as a whole. But although both are concerned with the same subject-matter, their approach is quite different.

Dr. W. D. Wright's *Researches on normal and defective colour vision*<sup>1</sup> is mainly concerned with a detailed report of experiments carried out by himself and his colleagues since 1926. The first forty pages give a brief review of the physiology of vision. The next section gives details of colorimetric equipment used in the experiments and a description of the methods of operation and calibration. The experiments reported are concerned with determinations of the luminosity-curves, colour-mixture, visual discrimination and adaptation-phenomena, and research on defective colour-vision.

Many of the experiments confirm earlier work but, by the use of improved apparatus, provide results with a more precise and intelligible meaning. In his account of this work he provides details of experimental technique and analysis of results. While the book is primarily of interest to the research-worker, the many different lines of enquiry are reported in such a fashion that their relation to earlier work, and their importance in an understanding of the physiology of colour-vision, are made clear.

Dr. Wright is well aware of the pitfalls that await those who traverse the ill-defined territory between physics, physiology and

<sup>1</sup> [For particulars see *Book Reviews*.]

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## WORK OF THE LISTER INSTITUTE

The annual report<sup>1</sup> was presented by Sir Henry Dale, chairman of the Governing Body, at the annual general meeting, 20 June 1947.

*Bacteriological, Immunological and Pathological Studies*.—An examination of the virulence, colony-appearance and capsuliformation of *H. pertussis* is being undertaken to see if this organism undergoes dissociation due to inherent or environmental factors, and to determine whether any of these factors influence the immunizing potency of vaccines. An investigation of gas-gangrene antitoxin extracted from the tissues of rabbits, guinea-pigs and rats immunized with *C. welchii* toxoid has shown that in all three species the lung has the highest antitoxin-content relative to the serum-titre. The chemical properties of the hydrolysates produced by hydrolyzing purified potassium hyaluronate with hyaluronidases have been shown to differ according to the source from which the enzyme has been obtained. Experiments to decide whether hydrolysis was brought about by a single enzyme or by a number of enzymes acting in series suggest that, in the case of streptococcal and staphylococcal hyaluronidase, more than one enzyme is involved. Work on the nuclear structure of bacteria has been carried out, and observations have been continued on pyrogens and other reacting substances in material used for transfusion. Batches of dextran prepared at Birmingham University have been tested for their antigenic and blood-pressure-restoring properties, and have been found closely to resemble Swedish dextran.

<sup>2</sup> [For particulars see *Book Reviews*.]



Studies on muscle-ischæmia suggest that the maintenance of the cycle for the metabolism of carbohydrate is a crucial factor in maintaining the normal permeability of the muscle-fibre, and that the changes leading to clinical shock after the release of a tourniquet may arise from failure to re-establish this cycle. The results of work on trichomoniasis in cattle, including the re-infection of animals which had infections of varying severities, indicate that subclinical infections convey no immunity. Successful bulk-production of *Trichomonas foetus* has been achieved.

No method of eliminating the bacterial flora of vaccine-lymph has been found which does not also reduce the amount of the virus. During investigations on this subject it was found that certain bacteria enhanced the proliferation of vaccinia-virus in experimental animals, this adjuvant effect apparently being proportional to the hyaluronidase produced by the organism. Furthermore, spread of bacteria appears to be proportional to hyaluronidase-production when staphylococci and virus are injected together, but not with staphylococci alone. The adjuvant action of hyaluronidase-producing streptococci and the virus appears to be even more striking. In a study of the formation of penicillinase by organisms of the subtilis group it has been shown that maximum production of this enzyme is obtained only when penicillin is added continuously during the growth-phase of the bacteria, and depends on adaptation during growth followed by lysis. The possibility of producing an antiserum against staphylococcal penicillinase is being investigated in view of its possible therapeutic value.

**Biochemical Studies.**—Investigations on the specific blood-group substances have shown that the electrophoretically homogeneous A-substance previously isolated from commercial hog-mucin and possessing both O- and A-specificity is in fact a mixture of two mucoids. The chemical and physical techniques employed were unable to separate the specific A and O blood-group substances from mixtures in which these mucoids occur. The A-, B- and O-substances occurring in pseudo-mucinous ovarian-cyst fluids have been further investigated, and the relationship between the reactivity of erythrocytes of all human groups to agglutination with anti-O sera and the capacity of individuals to secrete the so-called O-substances are being studied.

A member of the staff working in the Fysikalisk-Kemiska Institutet, Upsala, studied the adsorption-properties of gramicidin and tyrocidine. The former appears to be homogeneous when examined in alcoholic solution by the "front analysis" technique of Tiselius. Tyrocidine proved not to be homogeneous. A further quantity of the O-somatic antigens of *Bact. shigae* has been isolated, and methods suitable for its step-wise degradation are being elaborated. Work has continued on the "non-agglutinating" antibody, and has included the formation in rabbits of this type of immune body after injection of small quantities of *Bact. shigae* and of its purified O-somatic antigen and specific-polysaccharide and conjugated-protein components. Methods for the isolation of the main antigenic component from *Trichomonas foetus* have been elaborated.

**Biophysical and Physico-chemical Studies.**—Continued study of the purification of human fibrinogen has been specially concerned with the proportion specifically clotted by thrombin, and with the content of active and unactivated proteolytic enzymes. The interaction between tetanus toxin and antitoxin has been the subject of further study and, with a view to obtaining antitoxic sera showing only one end-point by flocculation, horses have been immunized with purified toxin and with toxin-antitoxin floccules.

In connexion with freeze-drying, the vacuum sublimation of ice in a tray-drier has been studied; the rate of vaporization per unit area per unit time, although 2 to 4 times greater than that in the centrifugal and transfusion-bottle driers, is only 1/400th of the ideal theoretical maximum. The apparent anomaly is related to the fact that molecular collisions with the condenser-surface are not all effective in condensation, the condensation-coefficient being less than unity. An ultrasonic generator has been constructed in which X-cut quartz disks are excited to vibration at the resonant frequency 500 kc./sec.—1 mc./sec. by application of high radio-frequency voltages. An investigation of the influence of ultrasonic vibrations on the protein molecule is being undertaken. Electro-phoretic analyses of sera and serum-fractions from foetuses and newborn lambs of ewes kept at different levels of nutrition have been carried out. Osmotic studies of haemoglobin have continued. The unit for the preparation of plasma-products administered by the Medical Research Council has been in operation during the year and has maintained a steady output of human fibrinogen, fibrin and thrombin. Since October 1946 there has been a regular

output of dried plasma for transfusion. A procedure for separating the immune-globulins from human plasma has been developed.

**Nutritional Studies.**—Further experiments on the nutritive value of wheat-proteins indicate about a 25% advantage for the proteins of the whole grain over white flour of 70% extraction.

**Nicotinamide and Related Compounds.**—It has been shown that, in pure and mixed cultures, growth, acid-formation and the production of nicotinamide by *Bact. coli* were stimulated by "ambamide" (*p*-amino-methyl-benzene-sulphonamide) in smaller concentrations and inhibited by larger concentrations, while nicotinamide-consuming bacteria such as *Proteus* and *Streptococcus* were inhibited by it even in small concentrations. Investigation of the contribution of intestinal bacteria to the nicotinamide requirements of man showed a parallelism between the relative densities of the *Bact. coli* population of the gut and urinary elimination of nicotinamide methochloride, both of which were considerably decreased after succinyl sulphathiazole and increased after ambamide intake. Biochemical examination of a patient with "black tongue" following oral penicillin showed that oral administration of penicillin to this patient, whose nicotinamide-status had been low beforehand, caused acute nicotinamide-deficiency which ceased after the discontinuation of penicillin or after administration of nicotinamide, but recurred with resumption of oral penicillin administration.

The Medical Research Council external scientific staff have continued their bacteriological, nutritional and blood-group studies. These have included analysis of the stages of tryptophan injection, the production of immunizing antigen in anthrax-cultures, the exploitation of *M. lysodeikticus* as a source of enzymes liberated from the cell, and further investigation of the Rh blood-groups. The National Collection of Type Cultures, whose original curator Dr. R. St. John-Brooks retired in October 1946, supplied more than 7,000 cultures to workers at home and abroad.

The Blood Group Reference Laboratory of the Ministry of Health has been concerned with the supply of standard A, B, O and Rh blood-grouping sera, and has been prepared to supply the rarer type of sera required for blood-grouping work.

The report records the deaths of several members, including Sir Joseph Barcroft, Sir Almroth Wright and Dr. H. L. Schütze.

L. T. Morton

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## AN ARGENTINE VIEW OF BRITISH MEDICINE AND SCIENCE

*Ciencia británica* (Editorial Bajel, Buenos Aires, 1946) by Prof. Mariano R. Castex, of the Academia Nacional de Medicina, contains the text of six lectures delivered to the Asociación Argentina de Cultura Inglesa during the years 1940, 1941, 1943, 1944 and 1945. The first two lectures review the contributions made to medical progress by British medicine and science, and the lecturer gives short biographical sketches of some of the outstanding personalities among British doctors and scientists since early times. The three following lectures tell briefly and lucidly the story of the foundation and development of the Royal Society, the Royal Institution and of the medical schools of Oxford and Cambridge Universities. The final lecture gives an account of the founding and work of the Cavendish Laboratory at Cambridge and of its most outstanding achievements.

The paper, type and format of this book, which contains 208 pages, add greatly to the pleasure of reading it.

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## JOURNALS NEWLY RECEIVED

Notes on journals recently received for the first time, usually in exchange with the British Medical Bulletin

*Revista dell'Istituto Sieroterapico Italiano* (Napoli) was previously known as the *Revista de Bioterapia e Immunologia*. It is published in two separate parts, one of which deals with biological and experimental work, the other containing articles of practical medical interest. The present number (Vol. 22, no. 1, January-March 1947) contains original articles on the history of penicillin

and its chemical and biological properties (E. B. Chain), streptomycin in the treatment of tuberculosis (C. Jandolo), the prolongation of the therapeutic effects of penicillin by a new method, i.e. by injection of the drug in a subcutaneous area (thighs) where a venous and lymphatic stasis has been provoked by the use of a tourniquet (E. Carlinfanti & F. Morra), penicillin in the treatment of blepharitis and dacryocystitis by F. Fontana, restoration of anti-diphtheric immunity by oral administration (M. Petrini), and non-demonstrable serological incompatibility in a case of apparently typical haemolytic disease of the newborn (E. Carlinfanti).

Of four Czechoslovak journals received, the first is the attractively-produced *Rozhledy v Tuberkulose* (Prague), a publication of the Masaryk League for the Prevention of Tuberculosis. The journal is edited by Professor Skládal. Several of the contributions have summaries in English, and in each number there are very adequate reviews of two or three foreign books and articles bearing upon tuberculosis. Vol. 6, no. 4 contains an article on rehabilitation methods at Papworth by R. R. Trail.

*Pediatrické Listy* (Prague) is the organ of the Czechoslovak Paediatric Society, and is published by the "Society of the Younger Generation of Doctors". It is edited by a board of nine, the chief editor being Dr. V. Baudiš, and appears six times a year, the annual subscription being 200 crowns [£1]. The main articles appear in Czech, with résumés in Russian, English and French; the subjects in this number include acrodynia; infectious diseases and neuropathic constitution; dysostosis craniofacialis (Crouzon); penicillin in the treatment of diphtheria; vitamin C in the treatment of pertussis; infant-mortality in Czechoslovakia. There are also abstracts of paediatric publications from USA, Switzerland, Sweden and Britain.

*Sociální Revue* is the organ of the Ministry of Labour and Social Welfare, and is edited by Dr. V. Berger. This is a monthly publication, price 8 crowns [10d.] for single numbers, annual subscription 90 crowns [9s.]. The main articles are printed in Czech, with abstracts in Russian and English; in this number they deal with trade-unions, social welfare, rehabilitation of victims of war and enemy persecution. Shorter notes are followed by a section on bibliography which lists publications from various countries on problems of social welfare, labour-conditions, food-control, etc.

The fourth of these Czechoslovak journals, *Československá Gynaekologie* (Prague, vol. 12, no. 5) gives summaries in English of the three main articles on the use of pentothal in gynaecology and obstetrics, treatment of pemphigus neonatorum, and eclampsia during the war, the latter giving comparative figures for pre-war and war years. The journal concludes with reports of scientific meetings, therapeutic notes, reviews of literature, the contents in English of the *Journal of Obstetrics and Gynaecology of the British Empire*, vol. 53, no. 6, December 1946 and European news-items.

*Folia Gynaecologica* (Genova, vol. 41, no. 3, 1946), a gynaecological journal from Italy, has been received. It contains 262 pages, and three articles are included, the first of which by Dr. Marion Ripetti discusses the advantages of reducing to the minimum the length of time patients remain in bed after gynaecological operations, and the circumstances in which it is advisable for them to do so. The second article deals with the histopathology of the placenta in toxæmias of pregnancy by Drs. Luciano Cirio & Marino Feraboli, and the third article is a study of hormone therapy in gynaecological disorders by Dr. Stelio Bonavita.

*Zdrowie Publiczne Miesięcznik* (vol. 63, nos. 1-2-3, 1947) a journal from the State School of Hygiene, Warsaw, is published in Polish with an English list of contents. Articles cover preventive medicine and epidemiology with emphasis on tuberculosis and the work of the National Health Council in Poland. Interest is not, however, limited to Poland. This number goes further afield with papers on the anti-tuberculosis campaign in Germany, diphtheria epidemic in Europe, and population-problems in Finland. There are reviews in Polish of British public-health text-books.

The first numbers of a new Hungarian journal, *Orvostudományi Beszámoló: Diurna Medicinalia*, have reached us from Szeged. The chief editor, Professor Béla Purjesz, professor of medicine at the University of Szeged, states that its purpose is to inform Hungarian doctors about recent researches and new books, and if possible to give accounts of papers read at congresses. If original articles are wanted by anyone in connexion with research, photographic or typewritten copies will be supplied on request. The Minister of Education, Julius Ortutay, welcomes the effort in a foreword to the first number. The contents include review-articles, abstracts of articles in foreign journals, and book-reviews. No. 3-4 lists forty European, Scandinavian, British and American journals from which articles are abstracted. The material in this new monthly periodical appears to be of a high standard, although production and paper are not very good and there are many typographical errors. The editorial office is at the Medical Clinic, the annual subscription is 120 Hungarian florins [c. £3]. It is published by the Free Trade Union of Hungarian Doctors, and all the editorial officers are professors and assistants of the University of Szeged.

Another Hungarian publication recently received is the official journal of the Hungarian Pharmaceutical Society: *A Magyar Gyógyszerész tudományi Társaság Értéktája*, which with volume 21 (1947) resumes publication after a lapse of two years. This contains original articles, in Hungarian, of pharmacological and pharmaceutical interest, and abstracts of articles in foreign journals, chiefly of pharmacological interest. It also publishes the *Minutes* of the Hungarian Pharmaceutical Society, and no. 3-4 includes reviews of Hungarian, German and Swiss books. This number contains amongst its original articles the text of a lecture given by Dr. Pál Turi on penicillin and other antibiotics; a summary in English is given of this article, which is chiefly based on the following monographs: Fleming, *Penicillin*, London, 1946; Herrel, *Penicillin and other antibiotics*, Philadelphia, 1945; Council of the Pharmaceutical Society of Great Britain, *Penicillin*, London, 1946. The journal is edited by Dr. Pál Lipták, professor of pharmacological chemistry, University of Budapest; the editorial office is at Üllői-út 26, Budapest VIII; the annual subscription varies, being 60 florins for those who own a pharmacy, 36 florins for employed pharmacists; and 18 florins for university employees and university students.

On entering its 10th year of publication, *Medicina del deporte y del trabajo* (Buenos Aires, vol. 10, no. 40, May 1946), restates its aim to study scientifically the special problems arising from sport and work and to consider methods and legislation for dealing with them. The editor expresses satisfaction with the tremendous advances made during the last ten years in the provision of safer and more healthy conditions and better medical services for workers in industry and for members of sports-organizations. This number contains original articles on the study of movement, the medical and social problems involved in cases of disability or illness arising from work or sport, their causes, prevention and legal implications. In addition, the journal contains the text of the resolutions reached by the second convention of doctors especially concerned with industry, held in November and December 1945 in Buenos Aires, and the text of the resolutions of the third south-American congress of doctors connected with sports organizations. A further section contains bibliographical notes and comments.

From Buenos Aires come two other journals. The first, *Boletín de la Asociación Odontológica Argentina*, is the official organ of the *Asociación Odontológica Argentina*. An editorial in this number (vol. 17, no. 199, January 1947) stresses the need for dentists to keep in touch with new methods and materials in dentistry and contains an account of a study-tour of the USA recently undertaken by members of the *Asociación*. A further section gives a list of the names of newly-elected officials of similar organizations throughout South America.

The second of these journals, *Index de neurologia y psiquiatria*, is published under the direction of Dr. Roque Orlando of the department of neuropsychiatry and the malarial-therapy centre of the Hospicio de las Mercedes, Buenos Aires. The number received (vol. 6, no. 7) consists of a single review-article and a short book-review section. The article, by Drs. Roque Orlando & Maximo Arndt, is on penicillin in general paralysis; after brief reference to the literature on penicillin in general, and surveying in more detail the work done on penicillin treatment of neurosyphilis, the authors give a fairly detailed report of their own experience of 57 cases of general paralysis treated with penicillin at their hospital.

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Latin America is also represented by three other journals—Brazilian, Cuban, and Mexican. In the first number of *Revista do Hospital das Clínicas* (São Paulo, vol. 1, no. 1, January 1946), the official organ of the Hospital das Clínicas of the Faculty of Medicine of the University of São Paulo, the editors express confidence that it will make the work of the Hospital das Clínicas more widely known in Brazil and in other countries, and they affirm that a very high standard will be maintained in the articles chosen for publication. Selection will be made by professors of the Faculty of Medicine. This number contains 112 pages, comprising 8 original articles and a section giving notes of medical meetings held at the hospital. The journal will be published quarterly.

*Anales de la Academia de Ciencias Médicas, Físicas y Naturales de la Habana*, (vol. 84, no. 1), commemorates the 84th anniversary of the foundation of the Academy and contains the text of the presidential address delivered by Dr. Jose A. Presno at the commemorative session held in May 1945. The text of an address by Dr. Raimundo de Castro y Bachiller given on the same occasion is also included. This address gives an account of the Academy's activities during the academic year 1945-46, and the journal also contains the text of a discourse by Dr. Angel Arturo Aballi on the child and the future of humanity, in which he stresses the need to provide a good environment and adequate social services for mothers and children.

In the first number of *Aisa* (vol. 1, no. 1, September 1946), the editor states that the object in launching it is to further the cause of medical education in Mexico, to help its citizens to co-operate individually in helping to improve the nation's health and standard of living, and to provide members of the medical profession with a medium for the expression of opinions and theories. This number contains seventeen original articles on a variety of subjects, including the campaign against tuberculosis with special reference to Mexico, problems of radiographical technique, and ascorbic acid and haemotherapy in the treatment of pertussis. There is also a section of abstracts from foreign journals.

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Symptomatic of intensification of interest in biophysics is the new French journal, *Atomes et Radiations*, published by Expansion Scientifique Française, which deals with physics, biology and medicine. The present number (vol. 1, no. 6) consists of two original articles—of which one, by Lacassagne, on "The influence of wave-lengths on certain lesions produced by the irradiation of mice" is the French version of a paper read to the Section of Radiology of the Royal Society of Medicine in March 1946—a report on the work done in Chicago on plutonium, an abstract-section, and a short book-review section.

Strasbourg, one of the most vigorous of French medical centres, provides *Strasbourg Médical*, which appears three times monthly, and is published under the general editorship of Dr. Paul-Emile Arbinet la Bessède, with the aid of an editorial committee of professors drawn from the medical faculties of Strasbourg, Lille, Besançon and Luxembourg. The present number (1947, vol. 107, no. 3, 25 January) comprises the following sections: a comment on current affairs consisting of a list of German doctors accused of war-crimes; a section of original articles; notices of new books; and a short section containing items of news about personalities. The original-article section includes a review of foreign work,

published since 1942, on neurology and psychiatry, by M. Schachter of Marseilles, who refers to the *Neurology* number of *BMB* (vol. 3, no. 1) and also to an article in the *Physics in Medicine* number (vol. 3, no. 3) by A. H. S. Holbourn on "The mechanics of brain injuries".

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In an editorial note to the reader of no. 6 of vol. 2 of *Cahiers Médicaux de l'Union Française*, J.-M. Montpellier, of Algiers, outlines the two-fold purpose of this journal: to establish direct contacts in the field of medicine and public health between the various units of the French overseas empire, and to keep the mother-country informed of the activities of her pioneer outposts. In addition to original articles, the journal includes reports of societies; reviews of books, journals and theses; a section containing local medical faculty and hospital news; and a section of comment and correspondence. Finally, there is an inset supplement on therapeutic questions; the one in the present number is on the treatment of burns. The original-article section in this number consists of six clinical articles based on the experience of the authors in various parts of the French empire, and one long review-article on avitaminosis and pregnancy.

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The title of *Archivio "E. Maragliano" di patologia e clinica* (Genova, vol. 1, no. 1-2, January-April 1946), is a gesture of homage to the memory of Dr. Edoardo Maragliano, who devoted more than 40 years of his life to work at the Clinica Medica di Genova. The journal is published at two-monthly intervals and is composed of two sections, one containing articles on scientific subjects and the other articles on clinical subjects. The present number contains three articles in each section with summaries in French, Italian, German and English.

Also from Italy is *Folia cardiologica* (Milano, vol. 5, no. 1, February 1946), official organ of the Gruppo Cardiologico Italiano, which is published at two-monthly intervals. It contains original articles only on subjects relating to the circulatory system. The present number comprises six articles, the first of which deals with the electrocardiogram in the prognosis of myocardial infarct by Dr. Giuseppe Frau. Further articles deal with the mechanism of ventricular fibrillation by Dr. Aldo Selvini, the circulatory system in exanthematous typhus by Dr. Arrigo Poppi, cardiological observations in obesity by Dr. Salvatore de Renzi, a study of the electrocardiogram in hyperthyroidism by M. Cellini and A. Selvini, and of rheumatic infection in the etiology of paroxysmal tachycardia by Giuseppe Frau.

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*Anales del Ateneo Médico Leonés* (Ordoño, Leon), the official organ of the Ateneo Médico Leonés, is published under the direction of its president, Dr. Enrique Salgado. Number 7 of volume 3 consists of 23 pages and contains two original articles, the first of which, by Dr. Joaquín García Morán of the Hospital Provincial, Oviedo, discusses the treatment of cancer of the stomach. The second article, by Dr. J. Alix of Madrid University, makes a comparative study of the advantages of temporary and permanent collapse in collapse-therapy of pulmonary tuberculosis. The journal also contains a reprint of an article in *Medicina Española* by Dr. F. Martínez on the diagnosis of moles, and there is a section containing abstracts from Spanish and foreign journals.

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According to the publisher, the Washington Institute of Medicine, the *Quarterly Review of Medicine*, an abstract-journal now in its 4th volume, is ambitiously intended "to keep physicians informed as to current discoveries and advances in internal medicine with a minimum of expenditure of time and effort." Internal medicine is used in the broadest sense to include cardiology and gastroenterology, infectious diseases and chemotherapy of infectious diseases. A few abstracts from the best-known and most-accessible foreign journals are included, but as the majority are American, the journal is of most interest to those needing access to the medical literature of that country. A useful addition is the inclusion in the heading of the author's official address.

# Historical Notes

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## SOME NOTES ON THE HISTORY OF LACTATION

At the beginning of the eleventh century A.D. the persian physician Avicenna, in the first book of his *Canon of medicine*, set down certain points in connexion with the feeding of infants.<sup>1</sup>

"Whenever possible, the mother's milk should be given and by suckling. For that is the aliment of all others most like in substance to the nutrient material which the infant received while in the womb—the menstrual nutrients of the mother. It is these which are changed into milk after parturition, and such milk is better adapted for the infant. . . . If there be anything to prevent the mother from giving milk to the babe—for instance, owing to her weakness or to the defective quality of her milk, or because it runs too quickly, a wet-nurse should be selected."

This selection needed great care. The woman ought to be between twenty-five and thirty-five years old, of medium build, with a good colour, strong-necked and broad-chested, the breasts firm, the nipples well-formed but not too large. Her character and personal habits must be good, her nature equable and "slowly aroused by the bad passions of the mind such as anger, gloom, fear, etc. For all these injure the constitution and may change the milk or pass into it, or even prevent its secretion. It is for this reason that some people reject a nurse who is stupid." Nor should the wet-nurse permit sexual intercourse,

"for this disturbs the menstrual blood and diminishes the quantity of milk and alters its composition. . . . Moreover she might become pregnant, in which case there would be a dual unpropitious influence—to the wet-nurse herself in that whatever is attenuated in the blood enters into the nutriment of the embryo, and to the embryo in that it loses as much from the mother's aliment as passes on to form milk."

The milk itself should be in consistence

"between coarse and fine; the colour white . . . the odour good, without acidity or pungency; the taste sweetish. . . . The quantity should be of a certain amount. It must be homogeneous. . . . The consistence may be tested by allowing the milk to run over the finger-nail. If it flows easily, it is thin; if it does not flow over the inclined nail, it is thick. Again, place some in a glass vessel, and drop a little myrrh into it, and stir the two together. The aqosity and the degree of caseity are then evident. The milk is landable and attempered if the watery part and cheesy part are equal."

The wet-nurse appointed to feed a newly-born child should herself have given birth in every way normally, between six and eight weeks previously.

In general, the health of the nursing woman should be maintained by a plain nutritive diet, by moderate exercise, by sufficient sleep, and if necessary by medicines. For the surest way of controlling the health of the child was by controlling the quality of the milk it sucked.

The child need not be suckled on the first day of life, save in exceptional circumstances and then preferably by someone other than the mother, but might be put to the breast so soon as the mother had sufficiently recovered from the ordeal of giving birth. It was to be fed "twice or thrice in the day at first, and it should not be allowed to take too much." Avicenna advised drawing off a little milk from the breast before each feed "to encourage and facilitate its flow." The nipples might be anointed with honey.

Most of the rules thus laid down by Avicenna—particularly those relating to the choosing of a wet-nurse, to the qualities desirable in the milk itself, and to the duration of lactation—continued to be observed with little modification for many centuries. They are repeated, for example, in Paulo Bagellardo's *De infantium aegritudinibus* (Pavia, 1472), the first printed book to deal solely with the rearing of young children; and in the almost contemporary monograph by Bartholomäus Metlinger, *Ein Regiment der Jungen Kinder* (1474).

By the eighteenth century the employment of wet-nurses was perhaps more common than it had ever been before, and the baby-farms which relieved these women of the care of their own offspring were in their notorious heyday. Yet the practice of rearing the child on milk or pap from a perforated cow-horn, pap-spoon or boat was growing. This trend in infant-feeding

was confirmed towards the end of the century, by the introduction of the conical glass feeding-bottle, its tubular mouthpiece enclosed in an overlapping finger of linen, parchment or wash-leather.<sup>2</sup>

Michael Underwood (1737-1820), the London obstetrician, who was among both the first and the last to hold the licence of the Royal College of Physicians to practise midwifery, especially praised the glass feeding-pot. It is, he wrote,

"so contrived, not only as to please the child by its resemblance to the nipple, and the milk coming slowly into its mouth; but also to afford the infant some little degree of labour, in order to acquire the quantity it needs, which the horn does not; by which means the food is also duly mixed with saliva."

He directed that the pot should be very carefully cleansed and scalded "at least once every day."

As to the food itself, in hand-feeding, Underwood recommended the milk of cows, or in some cases asses, to which

"should be added a little thin gruel, or barley-water. . . . A few weeks after birth, and I think in general the sooner the better, instead of the barley-water or gruel, there should be mixed with the milk a small quantity of a light jelly made from hartshorn shavings. . . . The design of the jelly is obvious and rational. . . . the milk of quadrupeds . . . is produced from vegetable juices only, whilst breast milk is formed by a mixture of animal and vegetable food. A little Lisbon sugar may be added. . . . At first the milk ought to be boiled, to render it less opening; but, when the child is several months old, or may chance to be costive, the milk need only be warmed."

Underwood at the same time was emphatic that "every child should be suckled, and always by its own mother, where her health can safely admit of it." At this point, Samuel Merriman, editor of the eighth edition (1826) of Underwood's *Treatise on the diseases of children*, added a footnote:

"I am convinced that the attempt to bring up children by hand proves fatal, in London, to at least seven out of eight. . . . and this happens, whether the child has never taken the breast at all, or having been suckled for three or four weeks only, is then weaned. In the country, the mortality among dry nursed children is not quite so great as in London, but it is abundantly greater than is generally imagined."

On the subject of weaning, Underwood expressed what was the orthodox opinion at the end of the eighteenth and beginning of the nineteenth centuries:

"A child ought to be in good health, especially in regard to its bowels; and ought first to have cut, at least, four of its teeth, unless that process should commence very unusually late. This seldom takes place till the child is near a twelvemonth old; and it may be observed that healthy women, who suckle their own children, and take proper exercise, do not usually become pregnant again in less time, and this, I conceive, may be considered as one intimation of the properest period. . . . Any preparation for weaning is generally needless. . . . I have lived, as it were, in the nursery for many years, and never found any ill effects from the sudden transition from breast-milk to artificial food when properly chosen."

By the middle of the nineteenth century, informed opinion on the duration of lactation had undergone a further change. In 1848, A. Peddie, physician to the Minto House Hospital and Dispensary in Edinburgh, wrote:

"I should say almost invariably at the conclusion of one year from the birth of the child, the secretion is found colostric even in the healthiest women. To this I have met with no exception; and, seeing that such is the case, I believe that lactation continued beyond the ninth month is decidedly improper. . . . Mothers, however, are often found continuing the child at the breast from personal considerations, without particular reference to its wants. What I allude to is, the supposition that during nursing protection is afforded against the occurrence of a new pregnancy. This idea, I think, is an erroneous one; and it is to be regretted that medical men have not set themselves more against the practice founded upon it."

He added:

"when a woman becomes pregnant during lactation, the microscope is a most important diagnostic guide; for then the colostric characters of the milk are apparent, and thus we can, without hesitation, advise an immediate abandonment of suckling."

The subject of lactation in the second half of the nineteenth century seems to be chiefly remarkable for the ingenuity of the feeding-bottles invented and the variety of proprietary baby-foods placed on the market.<sup>3</sup>

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- <sup>3</sup> Underwood, M. (1835) *A treatise on the diseases of children*, 9th ed., London, pp. 8, 44-6, 64
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B. M. Duncan



## THE STORY OF ARTIFICIAL INFANT-FEEDING

The scientific study of infant-nutrition is a modern development, the success of which can easily be demonstrated by comparing the health of the infant-population of today with that of 1847. But it would be a mistake to suppose that people of an earlier age were not aware of the problems which modern knowledge and equipment have enabled us to solve. It is just over a hundred years since the first proprietary baby-foods were placed on the market, but from the time of Soranus of Ephesus (fl. 100 A.D.), author of the oldest work extant on pediatrics, efforts were made to provide a substitute diet when it was impossible for the mother to feed her own child. Soranus confined himself to the choice of a good wet-nurse, judging the quality of the milk by the "finger-nail" test<sup>1</sup> which was still recommended by Smellie in 1752.

The fact that Soranus does not mention artificial foods, either as a supplementary, or as a completely-substitute diet, does not mean that such were unknown to the Romans, for there survive children's feeding-vessels, in terra-cotta, clay and even glass, some almost identical in shape with the modern version, from as early as the second or third centuries A.D. That the use of such vessels<sup>2</sup> was not confined to the Romans is shown by a thirteenth-century illuminated manuscript with an illustration of a woman feeding an infant in her arms by means of a horn, and a poem on the care of the body, written by Heinrich von Louffenburg in 1429, was printed in 1491, 1532, 1544, and 1549 with woodcut illustrations, one of which shows a child feeding from a "bottle" rather similar in shape to that of some of the roman clay vessels.

The first clear indication which we have of the kind of food given to children from these vessels is given in an excellent chapter on infant-feeding contained in Simon de Vallambart's *Cinq livres* (1565), the first french book on children's diseases. He there declares that it is customary to give other foods, in addition to breast-milk, from the age of three months or even earlier. (Paré thought it permissible from 10 or 12 days.) As a basis for such foods, he suggests cow's milk or goat's milk (which he thinks preferable) boiled with semolina or flour or white breadcrumbs, or sometimes with the yolk of egg. He condemns as a source of disease the practice of nurses who chew the food before placing it in the child's mouth, and he describes a feeding-vessel in the shape of a horn, with the narrow end shaped like a teat. Evidence from other sources proves that artificial feeding was by no means uncommon in sixteenth-century France. Among the Paris street-cries recorded in 1545 is one of "Milk for the babies", and Henri IV himself was reared on ass-milk.

The common belief that undesirable moral qualities of the wet-nurse could be conveyed to the infant by her milk may have had something to do with the adoption of alternative foods to breast-milk. One suspects that this fable may have originated in a dreadful warning given by a skilful physician to some matron who was reluctant to nurse her own child but, whatever its origin, physicians continued to make good use of it throughout the centuries, and it was repeated by Michael Ettmüller, Jean Astruc and Struve as late as the eighteenth century. This was the century which saw the beginnings of the infant-welfare movement and the establishment of foundling hospitals, which gave for the first time to physicians a controlled field of inquiry into the care of infants in health and disease. William Cadogan's classic *Essay upon nursing, and the management of children* (1748) was one of the first-fruits of this movement. His sensible and enlightened advice includes suggestions for feeding—"thin light Broths. with a little Bread or Rice boiled in them; . . . a little Bread and Water boil'd almost dry, and then mixed with fresh Milk not boiled . . . for boiling alters the Taste and Property of it."

In 1760 the french physician J. C. Desessart published his *Traité de l'éducation corporelle des enfans en bas age*, in which he attempted to table the comparative values of different kinds of milk, basing his judgment on chemical characteristics. He placed human milk first because of its low caseous content and the softness of its curd, and that of the ass and mare, the goat, the cow and the ewe followed in that order. He also mentioned malted food. In the following year Thomas Young presented a graduation thesis at Edinburgh which reported some pioneer work into

## Die Mutter. Ich wil mein Kindlin füttern ab/ Sein pflegen wol als ich vermag.



Um letzten sag ich dir furwar/  
Wenn nu das Kind ins zweyt jar/  
Der Frauen brüß hast wol gesogen/  
So soln sie im denn werdn enzogen.  
Jedoch nie all zu schwind zu gehe/  
Mit zarter speis dasselb geschehe.  
Von Zucker linden trünckelein/  
Sol man im stetigs geben ein.  
Auch speis die sich dawet leicht/  
Wo aber solchs nicht geschicht/  
Vnd gibst im speis von grober kost/  
Reins dings du denn gewisser hast/  
Denn das im darvon wechst der Stein/  
Der Krampff in henden füßen vnd bein.  
Man sol im doch in brissen eagen!

Wellcome Historical Medical Museum

Woodcut illustration to poem by Heinrich von Louffenburg, in the *Regiment der Gesundheit* (1549)

the chemistry of milk based on actual experiments, and in 1762 John Rutty brought out his *Analysis of milk and the several species thereof*. Hugh Smith, in his *Letters to married women* (1772) asserted his preference for "cow's milk to every other kind of nourishment in the early months where it is necessary to bring a child up by hand; . . . the milk of cows appears, I think, to be the properest substitute we can make for that of the breast; and will answer best after the first month or two without boiling." In the last year of the century, the third volume of the fourth edition of Michael Underwood's well-known work appeared with valuable new observations on infant-feeding, and a table (quoted from Boysson) showed the analysis of the various kinds of milk. He strongly condemned the use of "pap" (bread and water), and held that milk, preferably cow's milk, was the most proper food for infants, but that it should be boiled. Other interesting points were his recommendations of rice, tapioca and barley-water.

With all this renewed attention to infant-feeding came a revived interest in the feeding "bottle". George Armstrong, in 1777, advocated a horn, with the finger of a glove fixed on the narrow end as a teat, and in this he was warmly supported by Heberden. Hugh Smith offered to the public his well-known "bubby-pot", and various other kinds of pewter vessel were in common use, all with some kind of teat made from linen, parchment or leather over a small sponge. Struve (1798) condemned the use of pewter, and recommended a glass bottle with a short neck and a perforated cork, and stressed the great importance of keeping such vessels scrupulously clean.

It is impossible to say how strictly the advice of all these physicians was observed, but the mortality figures in the foundling hospitals (Paris, 80 %; Dublin, 99 %) at the end of the eighteenth

<sup>1</sup> [For a description of this test, see article (BMB 1141) in this number by B. M. Duncum.—Ed.]

<sup>2</sup> [See also article (BMB 1143) in this number on ancient feeding-bottles by F. Tubbs.—Ed.]



century show that something was seriously amiss with the care of infants as it was actually carried out in practice. In the early nineteenth century, according to Marshall Hall, "seven in every ten children brought up by hand" died. It is little wonder that, with such figures, good physicians continued to impress upon mothers the fact that nothing could safely replace breast-milk in the first year of life. Nevertheless, the changes in society resulting from the industrial revolution, the growth of cities, the increasing employment of women and the growing number of institutions devoted to children, all gave additional incentive to the search for a satisfactory infant-food. By 1840, the earliest proprietary foods were on the market, the first being the fashionable "tops-and-bottoms" (rusks) of Messrs. Robb & Co., closely followed by Hard's Farinaceous Food and Lemmon's Biscuit Powder, while in 1867 Justus Liebig introduced his well-known "malted food". Being in liquid form, this was soon ousted by preparations of concentrated and dried cow's milk, with or without other ingredients, in the safe and convenient form which we know today.

In 1884 Eustace Smith asserted that "The successful rearing of an infant by artificial means is not a difficult matter". At that time, this probably held true only of a physician or an exceptionally intelligent parent. Today, thanks to the great strides made in the science of nutrition, with its experimental research into essential food-factors, many excellent patent foods provide a complete diet for the young infant, while the spread of education, the establishment of child-welfare clinics and the day-to-day guidance which parents can obtain in them, have made Smith's words true of the population in general.

F. N. L. Poynter

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#### ROMAN INFANT-FEEDING-BOTTLES WITH PARTICULAR REFERENCE TO ROMANO-BRITISH AND BRITISH MEDIEVAL VESSELS

The subject of infant-feeding-bottles in earliest times belongs to the field of archaeology. Ancient writers do not mention them, but some antiquaries have claimed that certain greek vases circa 700 B.C.-500 B.C. (in the British Museum) are prototypes of roman feeding-bottles (Cuming, 1870). Dr. Sambon of Rome was also of the opinion that some roman feeding-bottles can be assigned to an early date, "perhaps the fifth or sixth centuries, B.C." (Sambon, 1909). The positive identification of certain roman vessels as feeding-bottles is due to ancient burial rites. Pliny wrote, to quote a translation by an english doctor, Philemon Holland (1635): "It is not the custome in any countrey to burne in a funerall fire the dead corps of any infant before his teeth be come up". This statement is supported as far as Britain is concerned by the bodies of babies sometimes found buried on romano-british villa sites, and child-graves.

It is to this practice of inhumation mentioned by Pliny, together with the provision of food and grave-furniture for the use of the dead, that posterity owes the recognition of early feeding-bottles. For certain small vessels now called *tetinae*, and once thought to have been oil-cruses for filling lamps, have been found in the graves of very young infants in place of the usual food-offerings. When it was noticed that the children had died "during the period of lactation" (Sambon, 1909), and the small bore of the sucking tubes of the vessels considered, the purpose of these was plain.

Feeding-bottles in the Western Roman Empire were usually made in terracotta of varying texture and colour, but an example executed in glass has been found in Paris (Sadler, 1909). A very small feeding-bottle made of lead is on record, but this was obviously of no practical value, and was probably intended as a votive offering (Sambon, 1909). The simplest type of roman feeding-bottle consisted of a conventional bulbous clay vessel possessing a wide opening at the top, but with an appendage in the shape of a spout of unusually small bore. An example found in Germany was about 7 cm. in height and of a fawnish colour (Cuming, 1870). A specimen found in Kent in 1848 (Crafter, 1848-9) and another presumably in the possession of the Wellcome Foundation may also belong to this class. Unfortunately the Wellcome Museum's infant feeding-bottles are packed away so that it has been impossible to identify their early bottle with certainty, but a photograph has been published (Still, 1931).

The second type of feeding-bottle was a taller, rather more elaborate version of the first. This was the commonest type and apparently persisted into Elizabethan times. The second roman type was some 10 cm. in height, with a narrower, slenderer neck than the first type, and possessed a handle placed at right-angles to the spout. An example found near Cologne was of fawn-coloured terracotta with the upper half shaded a deep chocolate-brown, but the romano-british specimens which have been found are of either a reddish or greyish colour. The fine example illustrated in fig. 1 was found on the site of Smithfield Market, London, on 2 November, 1865. It was some 11 cm. in height with a reeded handle so placed that the vessel could be held in the left hand.

FIG. 1. ROMANO-BRITISH FEEDING-BOTTLE



(F. Tubbs, after H. S. Cuming)

The third type of roman feeding-bottle was far more elaborate than either of its predecessors. Shaped like a human breast, it retained the handle at right-angles to the feeding-tube as in the second type. This third type was filled from the bottom by means of an internal tube running almost to the top of the vessel. Built on the "unspillable inkpot" principle, this vessel retained its contents uncontaminated by flies or insects, and the milk could be drawn out only through the feeding-tube (Sadler, 1909). An example illustrated in Still's work (1931) with the legend "Baby-feeder in terracotta: roman" appears to be of this type.

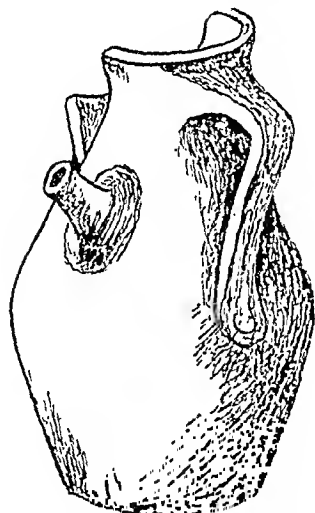
A few other shapes that do not belong to the main line of development were also employed; some were shaped like goat-skins, others like animals, but all possessed the feeding-tube that was distinctive of this type of vessel. One boat-shaped example (Still, 1931) has been found which suggests the shape of feeding-bottle now in use, but the date of this specimen is uncertain.

The medieval british feeding-bottle bore a striking resemblance to the infant feeding-bottle used in roman Britain and referred to in this note as the "second type". Like its predecessor it possessed a sucking-tube at right-angles to the handle, though the shape of the vessel itself approximated to that of the medieval jug. An example found where the Temple shore ran down to the Thames in London was discovered in 1864. It was made of earthenware and coloured with a dull greenish glaze. Nearly 10 cm. in height, it measured rather more in diameter than the Elizabethan specimen illustrated in fig. 2, which was slenderer though of the same height. This specimen was chosen for illustration here because it bears comparison with fig. 1, and like the romano-british specimen, was also found in London. The Elizabethan bottle had a yellow glaze, and was found in Old Swan Lane, Upper Thames Street, during September 1867 (Cuming, 1870).

It is not suggested that there is a direct line of descent from the romano-british to the Elizabethan feeding-bottle. The gap was probably bridged by the baby-feeder made from cow's-horn depicted in the thirteenth-century miniature in the Wellcome Museum (Still, 1931). The horn was still used in the latter half of the eighteenth century (Drake, 1930).

In conclusion, a brief allusion will be made to teats. It is obvious that some form of teat must have been used with the romano-british and medieval feeding-bottles, especially as some specimens were made of absorbent pottery that would cause the

FIG. 2. ELIZABETHAN FEEDING-BOTTLE



(F. Tubbs, after H. S. Cuming)

lips to adhere to the feeding-bottle if no protection was afforded. There is little doubt that the teat from a very young calf was employed, as in later times until the period when teats were first manufactured. In the eighteenth century two pieces of parchment were sewn together to make a teat, and from the nature of the material used this might well have been a survival from a much earlier period. It has been suggested (Cuming, 1870) that the Victorian practice of some country nurses, of drawing the finger of an old kid glove over the spout of a teapot used as an infant feeding-bottle, was an echo of the time when the teat of a calf was used with a feeding-bottle by our ancestors. The first teats to be made specially for infant-feeding bottles were large and rather cumbersome (Sadler, 1909), and obviously inspired by the animal teats employed for centuries, but even the shape of artificial teats has been modified by modern manufacturers, so that there is now little about the modern feeding-bottle that is reminiscent of the types of two thousand years ago.

F. Tubbs

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## 1144

## A SPANISH EPIDEMIC OF PLAGUE IN THE SIXTEENTH CENTURY

In a small book<sup>1</sup>, Dr. Don Jose Viñes Ibarrola gives an account of an outbreak of bubonic plague during August-November 1599, in Pamplona, the chief town of Spanish Navarre. The main features of the outbreak can be stated in a few words and the interest of this book lies in the fact that original contemporary documents are referred to and quoted. The town had been repeatedly visited by plague, and each time this occurred vows were made, but it was a case of "When the Devil got well, the devil a saint was he" and the vows were forgotten.

In November 1596, the disease was rife in Flanders and spread thence to various parts of Spain, and it is thought that Pamplona was infected by clothes and effects brought by ship from Dunkirk. Towards the end of 1599, women came from the French Navarre (Basses Pyrénées) and Magdalena, a suburb of Pamplona, buying cloth and other things and a few days later some fell sick and died. This is said to have been the start of the outbreak. That the epidemic was less severe than it might have been is ascribed to the energy of the Bishop Don Antonio Zapata y Mendoza, who

took a large part in the organization of preventive measures and kept up the spirits of the inhabitants. Guards were placed to prevent ingress to and egress from houses attacked; passes were given to those allowed to enter the area, and all those going out from it to work had to have a pass and return by the same gate as that by which they went out. Visitors were appointed to see that so far as possible no cases were hidden or overlooked. If anyone died who had not been medically attended, he could not be buried until a doctor had examined the body to see whether there were any buboes or other signs of plague, and if such were found, all in the house were quarantined.

The doctors concerned with the outbreak, and whose records and reports are given, are named, among them Joan de Lortia who, it is said, devoted 42 years of his life to the organization of anti-plague measures in various parts of France and Spain. The measures undertaken included, in addition to what has been stated above, isolation of patients and contacts, cleanliness of houses and household-goods, disinfection of houses, clothes, etc., all of which, it is now well known, would help in elimination of fleas, though the aims in view then were to avoid direct contact between the sick or possibly sick and the healthy, as the breath was believed to carry infection; the selling or giving away of clothes was forbidden and all washing of clothes had to be done at home. A hospital was established outside the infected area, staffed by doctors, an apothecary, nurses, guards and grave-diggers; there were special kitchens and cooks appointed to prepare the food.

How successful these measures were can be seen by comparing the figures of an outbreak in Santander nearby in 1596 with those of the Pamplona outbreak.

	Population	Cases	Morbidity	Deaths	Fatality
Santander	1,500	689	45.93%	600	87.0%
Pamplona	30,000	344	1.14%	276	80.2%

Thus, though the fatality rates were nearly the same, the morbidity was 40 times as great in Santander. Little need be said regarding the treatment of patients. Burning of aromatic woods in the rooms was advocated, and the taking of "plague tablets," one three times a day after a prayer to the Almighty for preservation from sickness. Laudanum, sandalwood, amber, musk were others in a long list of remedies. An interesting account.

H. Harold Scott

## 1145

## THE RENAISSANCE AND ENGLISH MEDICINE

In the recently-published<sup>1</sup> Thomas Vicary Lecture for 1945, Sir Arthur MacNalty remarks that it was not until the value of Greek thought was manifest to the practical Englishman that the influence of the Renaissance became widespread. Thomas Linacre, one of those who brought the new learning to Oxford, was instrumental in establishing, in 1518, the Royal College of Physicians, a body empowered to control the practice of medicine in and around the City of London.

As is shown in the famous Holbein painting, Thomas Vicary in 1540 received from the hands of Henry VIII the Act of Union between the Barbers and the Surgeons, and the new body thus formed regulated the practice of surgery in the London area.

Thus were the twin professions of Medicine and Surgery consolidated and regulated in Tudor times. Sir Arthur MacNalty enables his readers to visualize the conditions of life in England at that day by his clear sketch of the Tudor background. At the time of the Armada the population of England was under five millions. Wages were high and food was cheap, so that the Spanish nobles were amazed to find that the common folk fared as well as the king. The standard of nutrition was good—more people died of over-eating than of under-nourishment. Dress was costly and ostentatious, and the style of architecture was solid and ornate. That some attention was paid to public health was evident in the improvements in water-supplies and the regulations regarding disposal of sewage. The new learning spread from the Universities to the grammar schools, where boys were taught to read, write, and speak Latin. "On the whole, there was less illiteracy among the people of England in the sixteenth century than in the first half of the nineteenth."

<sup>1</sup> [For particulars see *Book Reviews*.]<sup>2</sup> [For particulars see *Book Reviews*.]

In spite of this apparent wave of prosperity there was much disease in England in Thomas Vicary's days. Although the incidence of leprosy had become reduced, syphilis was a deadly scourge. Tuberculosis was prevalent and there was much malaria. The "hot agues" appear to have been typhus, a disease frequent in the towns and in overcrowded gaols. But the deadliest epidemics of Tudor times were bubonic plague and the "sweating sickness", plague which had destroyed half the population of England. The worst epidemic of the century was in 1563-4. Flight from the infected area was the chief protective measure, but there were many regulations regarding sanitation and scavenging. The sweating sickness took the form of a succession of epidemics between 1485 when Henry VII landed at Milford Haven, and 1551, when the final outbreak occurred, and was described by Dr. John Caius in *A Boke or Conseil against the . . . Sweating Sickness*. The only modern malady which bears any resemblance to sweating sickness is miliary fever, "the Picardy sweat", of which there were many epidemics on the Continent, though not in Britain, between 1718 and 1906 or even later.

The Tudor physicians could do little to check the prevalent epidemics, but a few outstanding pioneers introduced reforms and improved the public health. Prominent among them was Sir Thomas More, 1478-1535, Speaker of the House of Commons, Lord Chancellor, humanist and health reformer, saint and martyr. The citizens of his *Utopia* (printed in 1516) esteemed health as the greatest of all pleasures. More's comprehensive programme of social medicine included a public water-supply, drainage, and cleansing, public hospitals for rich and poor alike and isolation-hospitals for infectious disease, communal meals, nursery schools, free education, eugenic mating—in brief, many of the aspirations of today. Appointed to take charge of health-measures, More pleaded with Henry VIII to spare the hospitals while pursuing his scheme for destroying the monasteries. But the king was bent on wholesale suppression and destruction. He ignored the advice of a few years later, in 1535, he sent poor Sir Thomas to the scaffold—"the blackest crime ever perpetrated in England under the form of law". It was only through the public-spirited action of the Corporation of London that five Royal Hospitals were preserved, and Henry was already on his deathbed when he agreed to pose as their first founder. If Sir Thomas More's enlightened policy had been followed, England would not have been obliged to wait for three hundred years for the initiation of national public health.

Another social reformer of Tudor times was Sir Thomas Elyot, whose *Castel of health* (1534) was widely read, while a third pioneer was the quaint Dr. Andrew Boorde, whose *Breviarie and Dyetary* are full of sound commonsense and shed a light on the social structure of that day.

Sir Arthur MacNalty also refers in this lecture to the revival of surgery under Thomas Vicary, and his successors Thomas Gale and William Clowes. We do well to honour such men, who made possible the discovery of William Harvey, the investigations of John Hunter, and the triumphs of present-day medical research.

Douglas Guthrie

## DOCTORS DIFFER

"The terse proverb, "Doctors differ", is a fundamental truth of medical practice. Commenting upon the seven spectators gathered around the teacher, Dr. Nicolaas Tulp, in Rembrandt's well known "Lesson in Anatomy", Dr. Harley Williams remarks<sup>1</sup> that to each of those young surgical apprentices the lesson conveyed a different meaning. All are filled with the same passionate curiosity, yet it appears in seven versions. It is right that doctors should differ, and it would be a sad day for the sick if their advisers were obliged to maintain uniformity in their outlook. Each good doctor is an individualist, and for each the way is different. From this most appropriate introduction the author proceeds to sketch the careers of five medical pioneers who dared to differ from their contemporaries and thus inaugurated new epochs in various branches of medicine: John Elliotson in psychological medicine, Hugh Owen Thomas in orthopaedics, James Mackenzie in cardiology, William Macewen in neuro-surgery, and Robert William Philip in tuberculosis.

<sup>1</sup> [In *Doctors differ*. For particulars see Book Reviews.]

The strange career of John Elliotson occupies about one third of the book. It is a neglected, yet significant, chapter in the history of medicine. Elliotson was a popular professor of medicine at University College, London, and in the front rank as a consulting physician, when he first espoused the cause of Mesmerism, or Animal Magnetism, as it was called.

His colleagues on the medical staff of the hospital were not impressed by what appeared to them to be an unwarranted departure from the recognized methods. Nevertheless the newly-established weekly journal, *The Lancet*, devoted many pages to full reports of Elliotson's lectures and experiments. Thomas Wakley, the editor, was fearless and progressive, and he wielded a powerful pen. His medical journalism showed no restraint, and led to a succession of lawsuits which merely strengthened his position.

With such strong support, it appeared for a time as though Elliotson might win his fight for recognition and establish a new branch of medicine. In the end, however, colleagues, Liston, Sharpey and others, demanded his resignation, while *The Lancet* withdrew its support and turned against him.

The materialism of the nineteenth century, with its excessive absorption in the physical body, could find no place for psychiatry in medical practice. John Elliotson was obliged to accept defeat, in a world not yet ready for his views. Only today is he coming to be recognized as a pioneer, and the author has done well to place him in the forefront of the quintette of heroes.

Hugh Owen Thomas, the Liverpool bonesetter's son, who introduced the methods of his father into regular practice and who passed on the torch of learning to his nephew, Robert Jones, may be regarded as the founder of orthopaedic surgery in Britain. His curious coat and peaked cap, his chain-smoking of cigarettes which he rolled himself long before the cigarette habit became universal, his breakfast of tea and bananas, his love of music and especially of the "Dead March in Saul," stamped him as no ordinary character. But there was no eccentricity in his simple and sensible dealings with the bones and joints of his patients. What the father did blindly and instinctively, the son did with reason and with a sound knowledge of anatomy. "His career is the standing refutation of standardized medicine," and although he wrote little and took no trouble to spread his doctrine, he built up the science of orthopaedics which was to be so brilliantly expounded by Sir Robert Jones.

Not very far from Liverpool stands the industrial town of Burnley, where a general practitioner, Dr. James Mackenzie, devoted the best years of his life to the study of the heart. The abnormal sounds, or "murmurs," and the irregularities of the pulse, such as missed beats, which had been regarded as dangerous omens, were all carefully studied by Mackenzie, who brought order out of chaos. He proved that sounds did not matter, and that many pulse irregularities were of no consequence, so long as the heart fulfilled its function. All this he did by devoting years of study to the records of heart- and pulse-movements traced upon smoked paper by an ingenious instrument of his own invention. He discovered what the heart could do and how far it might be trusted to fulfil its vital function. At the age of 53 he gave up his Lancashire practice and removed to London, where he rapidly achieved eminence. Alongside, and in contrast to, Sir James Mackenzie, the author places Sir William Osler, Professor of Medicine successively in three great centres, Philadelphia, Baltimore and Oxford. " . . . Osler was proud of what medicine had achieved, while Mackenzie was haunted by what medicine has still to learn, and . . . both philosophies are needed."

One of the most interesting chapters in this attractive book deals with the work of Sir William Macewen, with whose name is linked that of Sir Victor Horsley. A pupil and successor of Lister as Professor of Surgery in Glasgow, Macewen was a wholehearted follower of the antiseptic technique which he applied to the surgery of bony deformities, and later, to brain-surgery. His wonderful successes in the treatment of brain-abscesses were set forth in his book on *Pyogenic diseases of the brain and spinal cord* which remains one of the classics of Surgery. Nor were Macewen's researches confined to surgery. He discovered fresh facts regarding the growth of antlers in deer, and he was a keen student of nature. Ever an individualist, he was certainly a doctor who differed from his contemporaries; he " . . . moved in his own orbit, by his own light," and rather prided himself on the fact that he was not a co-operator.

Sir Victor Horsley was another great pioneer of brain-surgery and a noted controversialist who held extreme views on Women's Suffrage and Total Abstinence when these subjects were the centres

of much debate. The author has clearly depicted his scientific achievements as well as his eccentricities.

The final chapter is devoted to the achievement of Sir Robert W. Philip in the fight against tuberculosis. Here Dr. Harley Williams speaks with authority, of his old teacher, in the field which he has made his own. Philip made fresh air a homely remedy, and not merely the prerogative of those who could seek its benefits in Switzerland or in the Black Forest. His Tuberculosis Dispensary, opened in Edinburgh in 1887, marked the beginning of a new era, a great experiment in social medicine. Philip evolved a scheme in which all the needs of the tuberculous patient were met, although in his day he was considered a rash enthusiast. A man of wide culture and a noted orator, he exercised a fascination over many generations of students. His methods have been adopted all over the world.

The American pioneer of open-air treatment for tuberculosis was one who was himself a victim and who found new life in the Adirondack wilderness. The sanatorium at Saranac Lake was the first of many such institutions in America.

In his admirable sketches of those differing doctors, Dr. Harley Williams has produced something more than a series of biographies. He has credited his five heroes with five separate philosophies, each one true. He has shown that there must always be an art, as well as a science, of medicine, and he has proved conclusively, in this delightful book which will fascinate many readers, that however widely doctors may differ, they will work with one object in view, the provision of health and the prevention of disease.

D. G.

1147

### THE ROTUNDA HOSPITAL 1745-1945

In his recently-published history<sup>1</sup>, Professor O'Donel Browne tells the story of the Rotunda Hospital, Dublin, from its foundation in 1745 by Bartholomew Mosse, up to 1945.

The book is divided into six sections. In the first two of these, the author describes the development of the hospital buildings and administration from a small beginning in a house in George's Lane. This was soon found to be inadequate and a new Dublin Lying-in Hospital was opened on the present site within 12 years. Reserved at first for maternity cases only, a gynaecological department was opened in 1835. Short biographies are also given of successive Masters.

The third section is devoted to an account of the age-long struggle against puerperal fever, in the treatment of which the Rotunda at times lagged sadly behind. The author rightly stresses the excellent work of Labatt and Collins. This section is extremely interesting and recounts the efforts made by various Masters to combat a deadly disease, the cause of which, before Holmes and Semmelweis, Pasteur and Lister, was a mystery to them.

The fourth section gives an account of the progress of operative midwifery, including the use of the forceps, caesarean section, and destructive operations on the foetus. The author credits William Smellie with three caesarean sections performed for placenta praevia, but omits to state that these were carried out only after the death of the mother. Nearly one and a half centuries were to elapse before Lawson Tait was to stagger the obstetric world with a recommendation of caesarean section for placenta praevia.

The development of anaesthesia and gynaecology are described in the fifth section. The author falls into error here in recounting that delightful but wholly inaccurate story of how Sir Walter Scott advised Sir James Young Simpson that his coat-of-arms should be "a wee naked bairn" with the inscription "Does your mother know you're out?" Sir Walter Scott died in 1832. Simpson was knighted in 1866 (not 1870).

Eclampsia is the subject of discussion in the final section. As the author rightly claims, "the name of the Rotunda is inseparably linked with eclampsia because of the advances made there in its treatment". The name of Hastings Tweedy is forever associated with the problem of eclampsia, and his views and work are rightly given prominence.

The author considers Mosse, Ould, Clarke, Labatt, Collins, Macan, Smyly and Tweedy to have been the greatest Masters. Few will dispute his verdict.

The volume concludes with a chronological table of the main events in the Rotunda under each Master, plus a similar synopsis of the main events in Dublin and elsewhere in the obstetric world. There is also a graph showing the number of deliveries and death-rate during the 200 years.

At times, the author has not been able to resist the temptation to branch off into the history of obstetrics in general apart altogether from the history of the Rotunda Hospital. This is most pronounced in the section devoted to operative midwifery. To the keen student of obstetric history, this is probably no drawback, but one feels that, occasionally, the author is rather getting "away from the point". Nevertheless the story is a fascinating one, well told, and can be strongly recommended to all interested in the history of medicine and of obstetrics in particular. It may come as a surprise to learn that Irish Sweepstakes have not solved the financial problems of the Rotunda.

The book is beautifully produced and contains many handsome illustrations.

J. H. Young

## Book Reviews

### ANATOMICAL TERMINOLOGY

#### 1148 Anatomical Terms: their Origin and Derivation

E. J. Field & R. J. Harrison. Cambridge, W. Heffer & Sons Ltd., 1947. vi + 165 pages. 17 x 10 cm. 7s. 6d. [£0.375]

This small book, excellent within its limits, ought to encourage the medical student to think about the anatomical terms he encounters. By discovering their meanings he will often be helped to understand structure and function in the processes they describe, and will acquire a taste for the history of anatomical discovery. The book will be equally useful to the professional anatomist. It is well produced, pleasing to handle and to read, and unlike most books of reference will fit easily into the pocket. The authors modestly define their purpose by a series of negatives: their book is not meant to be a medical dictionary nor an authoritative etymological treatise and will not "make up for the lack of a classical education". Yet it contains a quantity of useful instruction not easily findable in any other one source.

Drs. Field and Harrison assume in their readers a knowledge of the application of anatomical terms and concentrate on expounding derivations chiefly from Greek or Latin roots. This they do with care, stressing the evolution of meanings from a direct to an applied "lay" sense and thence to the anatomical meaning, often by analogy. This derivation is in many cases expanded by a discussion or criticism of the aptness of the term and a note on its earliest use in anatomy. For example the note on *fibula*, after giving the Latin original of "a pin or skewer" for fastening, hence a brooch, points out that Vesalius first used the word in anatomy, goes on to discuss *infibulation* by a silver needle and concludes: "Since all *fibulae* are thin and, in certain animals, often very narrow . . . and have sharp tips . . . it is probable that they were so-called from their resemblance to needles rather than brooches." Where the term includes the name of a discoverer they provide a thumbnail biography of the man thus commemorated by his "eponym". They do not try to give the precise references, which may be found in Dobson or Morton or other of the authorities to whom they refer, though occasionally they offer a date, as the introduction of the term "thyroid" in 1646, where the introducer ought to be Wharton, not Warton. This historical approach gives a human interest to what would otherwise be a dry record of grammatical usage. Sometimes the authors go beyond their scope: particularly successful in this way are the miniature essays on the history of certain terms, for

<sup>1</sup> [For particulars see *Book Reviews*.]

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instance, *muscle*—which traces the development of muscle-names from Galen who used few names for muscles, "... considering [them] in topographical groups and numbering the individual muscles of each group", through Vesalius to Sylvius and Riolan, who "made attempts towards the introduction of a definite nomenclature" to Cowper, Douglas and Albinus who perfected it. But some of these notes give irrelevant information, for instance that on *mitral*, which describes the various ancient garments named *mitra*, only to conclude that: "The bishop's mitre, as we know it... is the only one of the various forms of *mitra* to which the atrio-ventricular valve bears a resemblance", or that on *stapes*, which discusses the Romans' ignorance of stirrups.

The list is remarkably comprehensive, although common english words and self-explanatory terms have been deliberately omitted. A few general scientific terms, such as "eugenics" and "phylogeny" have been put in, and so have some pathological eponyms such as "Parkinson's disease", a random choice from a vast field. One lack might be made good in a new edition, hints for pronunciation. Greek long e and long o are sometimes marked, but many ambiguities remain. Disregard for uniformity is of less importance and may even bring home the variant meaning of a word in various contexts; for instance, words ending in -oid are usually given as from the Greek for "shape" but under *pitheoid* this suffix is translated "like". Similarly the list of references, recommending a well-chosen group of authorities, is set out regardless of uniform bibliographic style. There are a few minor mistakes and misprints, for example under *platycnemia*, where, as the context requires, greek "kne" is in fact "shin" and not "knee". No errors or omissions of importance have been detected, and the book can be warmly recommended as useful at first reading and of growing interest the more it is studied.

W. R. LeFanu

## BLOOD-DONORS

### 1149 Der Blutspender

H. Willenegger & R. Bötzel. Basel, Benno Schwabe & Co., 1947. 197 pages; 48 illustrations. 22 x 16 cm. Sw. fr. 10.

(i) Historischer Rückblick; (ii) die Entwicklung des Spender- und Transfusionswesens nach Entdeckung der Blutgruppen; (iii) der Spender; (iv) die Organisation des Spender- und Transfusionswesens; (v) der Spende- und Transfusionsdienst in den einzelnen Ländern; (vi) der Spende- und Transfusionsdienst in der Schweiz; (vii) Schlusswort. Anhang.

The development of blood-transfusion services in Britain and the USA was greatly hastened by the demands of war. In Switzerland, amongst other countries, this special stimulus was lacking, and the transfusion service now finds itself comparatively backward. This situation has prompted the authors to review the whole question of blood-donation.

Before the war, donors were mainly of two kinds, namely, relations or friends of the patient, many of whom gave blood on one special occasion only, and professional donors, who gave blood regularly in accordance with a special tariff; this varied greatly so that the price in 1937 varied—for example, from £7 per 500 cm.<sup>3</sup> in New York to £1½ for the same amount in Berlin. In Portugal, it was worth as much as twenty days' paid holiday if the donor had never given blood before. In addition to these two types of donor, there were in Britain, Holland and a few other countries, donors organized by the Red Cross, who gave their blood free of charge. Under war-conditions it was necessary to recruit very large numbers of donors to supply blood for production and storage of plasma. As a result, blood-donation became highly impersonal, and education of the public was needed to bring home to them the way in which medical services had come to rely on having stored blood and plasma constantly available. Now, in peace, the public must be made to feel that blood-donation by healthy adults has become a social duty. The appeal that was made so successfully in time of war must succeed in peacetime, and it is essential to learn how to appeal to the same philanthropic motives in potential donors.

There is a very interesting history of blood-transfusion, containing some details which do not appear in many accounts; for example, there are particulars of the first transfusion from one human to another, which was carried out in 1823 by James Blundell, Professor of Physiology and Obstetrics at Guy's Hospital, London.

The book is obviously meant for the lay reader as well as for doctors, and it therefore contains only a short description of the blood-groups. Nevertheless, one feels that the Rh factor is altogether too summarily dismissed for a book published in 1947. Moreover, the statement that one occasionally meets a naturally-occurring anti-Rh antibody of the cold-agglutinin type is untrue no certain case of a naturally-occurring anti-Rh antibody having yet been described. Nevertheless, criticism of small details must not be allowed to obscure the impression that this is a well-informed book which gives one of the best available accounts of the development of blood-transfusion.

Finally, it is impossible to avoid mentioning the striking cover. This shows one shadowy figure pouring out red lines of blood from his heart to a stricken man below. This conveys excellently the feeling of the life-saving importance of blood-transfusion.

P. Hollison

## CANCER: AN UNCONVENTIONAL VIEW

### 1150 Metabolic Therapy of Cancer

Ernst Freund. London, Daniel Godwin, Ltd., 1946. 178 pages. 22 x 14 cm. 12s. 6d. [£0.625]

(i) Cancer cells and blood serum; (ii) chemistry of the active factors in the cytolytic reaction; (iii) correlation between carcinolytic and carcino-protective factors; (iv) carbohydrates and carcinoma; (v) origin of lytic and protective components of sera; (vi) specific intestinal flora and malignant tumours; (vii) chemistry of predisposition for cancer; (viii) influence of intestinal acids on growth; (ix) metabolic interpretation of tumour growth and interpretation of clinical phenomena; (x) the Freund-Kaminer diagnostic reaction; (xi) metabolic cancer therapy.

The name of Ernst Freund recalls a phase of cancer research which has, for a time, occupied a position of influence. To modern generations of cancer research-workers, Freund's theory of tumour-etiology, the Freund-Kaminer sero-diagnostic test, and the suggested principles of therapy based on these investigations, are perhaps less well-known. An english translation of a book by the originator of this half-forgotten chapter of cancer research, might, therefore, appear both timely and desirable.

As mentioned in the preface of the book, the investigations arose from an early observation by the author in 1885, while he was still a student. It ended half a century later with the ambitious exposition of the cause, diagnosis, and treatment of cancer. Underlying these researches was the idea that normal serum caused lysis of cancer cells, while serum from cancer patients not only failed to produce this effect, but actually protected such cells from the lytic action of normal serum. This eventually formed the basis of the Freund-Kaminer sero-diagnostic test for cancer. Freund believed, moreover, that "instead of confining ourselves to an investigation of the action of the malignant cell on the organism, we ought to investigate the action of the organism on the malignant cell". This directed his attention to the anabolic processes of the living cell, and led him to the study of dietetic and other extraneous factors from which the cell builds up its characteristic protoplasm. An analysis of the "carcinolytic" factor in normal serum, and of the "anticarcinolytic" or "protective" factor in cancer serum, led Freund to the conclusion that the former was a saturated, and the latter an unsaturated dicarboxylic acid, each bound to some other component (euglobulin or nucleoglobulin) in the serum. These dicarboxylic acids he considered to be formed in the intestine by bacterial action, and an examination of the bacterial flora of cancerous and normal people pointed to the presence of a specific type of *B. coli* in the former, which he held to be responsible for the formation of the unsaturated acid—thus representing a predisposition towards cancer. This, in turn, led him to formulate a special dietetic regime for cancerous patients.

It is not the purpose of this review to analyze the complicated evidence on which these views are based, nor to offer an appraisal of the theories resulting from this work. That could be left to a detailed assessment of the voluminous literature which has already accumulated on the subject. The reader will, however, be disappointed if he expects such an unbiased survey in the present book.

It may be asked, then, for whom this book was intended. Not for the lay public, nor for the medical student, since it represents a highly specialized and one-sided approach to the cancer problem. Nor as a guide to the clinician or clinical pathologist, since the practical value of the Freund-Kaminer sero-diagnostic test has greatly diminished with the passing of time, while the therapeutic applications have never commanded serious attention, and are in definite conflict with modern researches on the subject. The medical historian, who may seek a balanced perspective of this complicated field, or the experimental scientist, who may desire to learn more of this work in the hope of being able to salvage any truths that may lie hidden in this vast store of experimental data, will both be disappointed in this book, and will turn rather to the existing books and reviews (e.g. by Stern & Willheim, Hirsfeld, and others), in which the literature on the subject is more fully presented, and in which some attempt, at least, is made to evaluate the conflicting claims of different authors.

The translation into English is admirably performed, but greater care might have been taken in the accuracy of the scientific terminology.

I. B.

## CARDIOVASCULAR DISEASE

### 1151 Cardiovascular Disease in General Practice

Terence East. Second Edition. London, H. K. Lewis & Co. Ltd., 1946. x + 198 pages; 40 illustrations. 21 x 14 cm. 12s. 6d. [£0.625]

(i) The interpretation of symptoms; (ii) physical examination of the heart; (iii) heart failure; (iv) the treatment of heart failure; (v) failure of the coronary circulation; (vi) pericardial failure; (vii) the infections of the heart; (viii) subacute bacterial endocarditis; (ix) chronic valvular disease; (x) pericarditis; (xi) aortic aneurysm; (xii) aortic regurgitation; (xiii) aortic stenosis; (xiv) auricular fibrillation and flutter; (xv) disorders of conduction; (xvi) the cardiovascular system in anaemia, chronic pulmonary disease, chronic renal disease, minor infections, anaesthesia, pregnancy, athletics, deficiency conditions; (xvii) diseases of arteries and veins; (xviii) congenital diseases of the heart; (xix) the heart in middle age and onwards; (xx) some aberrations and the normal heart. Index.

The specialist called to write for the general practitioner is in a dilemma. Dealing with a subject like cardiovascular disease, he should write about it as a general practitioner is likely to see it. In Britain, this means that electrocardiographic detail should be omitted, and common conditions should be discussed fully. At the same time a tendency to "write down" the subject for the general practitioner should surely be avoided. The general practitioner has had the same basic education as the specialist, and is often capable of understanding more about the rationale of diagnosis and treatment based on pathological and physiological principles than he is given credit for. The practitioner who takes the trouble to read monographs prepared for him should be given enough detail to stimulate his interest in his own particular approach to the problem.

Dr. East writes clearly and vividly in this little book. He points out that the head of the poet Alfred de Musset shook with his Corrigan pulse, but unfortunately he does not instruct the doctor on how to look for and interpret capillary pulsation. Lengthy accounts are given of coronary thrombosis and subacute bacterial endocarditis, but there is no mention of penicillin therapy.

The chapter on hypertension should have been considerably larger than that given, in view of the fact that this condition is now the "Captain of the men of Death". One instrument which the practitioner should have and use is surely an ophthalmoscope, and yet only six rather poor lines are given to the examination of the retina which is so valuable in diagnosis and prognosis. Thrombophlebitis is a common and troublesome condition for the general practitioner, and one which he should understand as fully as possible, and yet the condition is here disposed of in about half a page. Our tendency to take little interest in this condition may be due to the fact that heparin and other anticoagulant measures in treatment have been impossible to apply in Britain for economic and other reasons.

It is easy to be critical. Dr. East writes well and his opinions are sound. The general practitioner who reads this book will be the better for it, but he will have to seek a good deal more information elsewhere if he is to understand the diagnosis and treatment of cardiac patients in general practice.

### 1152 Heart Arrhythmias in Children

*Acta Paediatrica*, 1947, 34, Suppl. 1

Bernhard Landtman. Helsingfors, Mercators Tryckeri, 1947. 107 pages; 17 figures. 23 x 14 cm.

(i) Material and method; (ii) sinus arrhythmia; (iii) extrasystoles; (iv) flutter and fibrillation; (v) paroxysmal tachycardia; (vi) conduction disturbances; (vii) rare arrhythmias; (viii) heart action in premature infants. Summary. Literature.

Within the period 1936-1946, 5,600 children under the age of 16 years were examined at the Heart Station of the Crown Princess Lovisa's Children's Hospital, Stockholm. Impressed by the disparity between the state of knowledge of the heart arrhythmias in adults and children respectively, Dr. Landtman set himself the task of analyzing the data obtained from the examination of these children with special reference to the frequency of occurrence of the different types of arrhythmias and their clinical manifestations. The present monograph is essentially a presentation and an appreciation of the findings in the 126 children (2.25 % of the total) in whom pathological arrhythmias were observed.

The account of each arrhythmia is prefaced by a succinct preamble which includes comments on the physiological or pathological processes involved and a fairly complete survey of the relevant literature. The data of the present investigations are then presented and a discussion and evaluation added.

Sinus-arrhythmia is considered in relation to age and the state of the heart, whether normal or diseased. The conclusion supported by statistical examination of the findings indicates that sinus-arrhythmia is more common in later than in earlier childhood, thereby confirming a similar observation published by Mackenzie in 1902. The data suggest that sinus-arrhythmia is less common in children with congenital heart-disease and rheumatic heart-disease than in normals although, as the author appears to realize, the numbers of observations are too small upon which to base a firm statistically-significant conclusion.

Extrasystoles were found in 1.5 % of the cases, the ventricular type being more common than the supra-ventricular (including nodal) type. The author conforms with common usage which allows the rather loose application of the term "extrasystole" to a beat arising from an ectopic focus and to a premature beat, as well as to an interpolated premature beat or true extrasystole. This is unfortunate, since a further breakdown of the data might have helped to throw light on the difference in prognostic significance, if any, between the different types of premature beats or extrasystoles.

Nine cases of complete auriculo-ventricular block in children, whose ages ranged from a few hours to 11 years, are added to the literature. The author, with good reason, believes them to be examples of congenital block. However, the basis for the conclusion that the usual cause of the block in these cases is a septal defect may be questioned on the ground that the diagnosis of a septal defect seems to have been made largely, or entirely, from phonocardiographic investigations of a systolic murmur which was present in all the cases. Admitting the assistance which phonocardiography may lend to clinical diagnosis, and the technical advances made by Mannheimer and his group, whose methods were followed in this work, the clinician will require more convincing evidence of the existence of a septal defect than phonocardiographic demonstration of a systolic murmur.

An interesting and valuable chapter is devoted to heart-action in premature infants. From his observations on 63 premature infants, of whom 53 were less than one month old, the author concludes that disturbances in heart-action are not more usual in premature than in full-term children.

Two new cases of the interesting and uncommon condition of interference-dissociation in boys aged 7 and 15 years respectively are described in the chapter on rare arrhythmias. In one of these cases the arrhythmia disappeared spontaneously; in the other, vagal depression and sympathetic stimulation restored normal rhythm.

While this work discloses nothing which was not known before, it is a worthwhile contribution to the subject in the sense that it is a record of a relatively large number of carefully-analyzed observations from which no unwarranted conclusions have been drawn.

The translation into English, while at times erratic, is on the whole adequate.

# 1153 Heparin in the Treatment of Thrombosis: An Account of its Chemistry, Physiology and Application in Medicine

J. Erik Jorpes. Second Edition. London, Geoffrey Cumberlege, Oxford University Press, 1946. 260 pages; 24 illustrations. 22 x 14 cm. 18s. [£0.9]

Part I. The chemistry and physiology of heparin. (i) The discovery and chemistry of heparin; (ii) the mode of action of heparin; (iii) the site of formation of heparin; (iv) the strength of pure heparin and similar anticoagulants; (v) miscellaneous clinical uses of heparin; (vi) dicumarol, the haemorrhagic agent causing "sweet clover disease". Part II. Heparin and thrombosis. (vii) Heparin in the treatment of thrombosis; (viii) heparin in latent thrombosis, in pneumonia and other inflammatory conditions; (ix) the prevention and treatment of thrombosis with dicumarol; (x) some aspects of the pathogenesis of thrombosis and of its treatment; (xi) social aspects of thrombosis. Bibliography. Index.

The first edition of this book, published in 1939, was almost entirely devoted to the chemical and physiological properties of heparin—a field in which Dr. Jorpes is the acknowledged master. In the last few years, however, the treatment of venous thrombosis and pulmonary embolism with heparin, very largely the work of the pioneer studies of Swedish workers, has undergone a profound change. Part II of the second (1946) edition of Dr. Jorpes' book, which occupies some two-thirds of the much-enlarged volume, deals with the place of heparin and dicumarol in the prophylaxis and treatment of thrombosis. A most complete and fully-documented account of the development of the Swedish work is given, and it is shown that both the immediate mortality and, more importantly, the late morbidity of deep venous thrombosis, which is apparently particularly common in Sweden, can be largely prevented. Dr. Jorpes draws attention to a fact which deserves to be stressed, namely that pulmonary embolism following deep venous thrombosis is met with as frequently on the medical side as on the surgical side of a general hospital. A feature which should be of particular interest to clinicians is the chapter on the social aspects of thrombosis, wherein it is shown that the average case remains in hospital 6 weeks, with an annual loss to the Swedish nation of 600,000 dollars exclusive of lost working-time. There are about 5,000 new cases of thrombosis annually in Sweden, with a net loss of efficiency greater than that arising as the result of road-accidents of all kinds. A form of therapy by which the period in hospital is shortened to 5-10 days, and the frequency of such complications as induration and ulcer is strikingly reduced, assumes a position of social and even national importance. The data upon which conclusions are based are fully given.

The first part of the book deals with the chemistry, physiology, mode of action and site of formation of heparin, and with the methods available for its biological assay. Much of the work here is Dr. Jorpes' own, and the story is fascinatingly and clearly unfolded.

This monograph is an example of the value of such complications, not only to the scientific worker in the same field, but to the teacher and the more general reader. The first edition is already well known to, and esteemed by, Dr. Jorpes' fellow-workers; the second should bring him into contact with a much larger number of physicians and surgeons who cannot fail to be interested in the problem.

## CLINICAL PATHOLOGY

### 1154 Recent Advances in Clinical Pathology

By various Authors. Produced under the auspices of The European Association of Clinical Pathologists. General Editor, S. C. Dyke. London, J. & A. Churchill, 1947. xii + 468 pages; 34 illustrations. 21 x 13 cm. £1 5s. [£1.25]

Section I: Bacteriology. (Editor: Robert Cruickshank.) (i) Laboratory diagnosis of enteric infections; (ii) laboratory diagnosis of typhus fever; (iii) laboratory diagnosis of streptococci; (iv) laboratory diagnosis of staphylococci; (v) laboratory diagnosis of anaerobic infections; (vi) laboratory control of chemotherapy; (vii) laboratory diagnosis of leptospiral infections; (viii) laboratory tests in venereal disease. Section II: Biochemistry. (Editor: E. N. Allott.) (ix) Liver function tests; (x) estimation of the prothrombin time; (xi) control of the blood chemistry in gastro-intestinal disease; (xii) excretion tests in Addison's disease; (xiii) biochemical aids in the diagnosis of nutritional

deficiencies; (xiv) crystalline forms and solubilities of sulphonamide derivatives; (xv) photoelectric colorimeters; (xvi) micromethods of blood analysis. Section III: Haematology and cytology. (Editor: B. L. Della Vida.) (xvii) Haematological nomenclature; (xviii) the myelogram and its clinical applications; (xix) the Rh factor; (xx) the transfusion of blood and blood products; (xxi) blood grouping; (xxii) the sedimentation rate of the red cells; (xxiii) the diagnosis of pernicious anaemia and the assay of liver extracts; (xxiv) infectious mononucleosis and the differential Paul-Bunnell test; (xxv) the analysis of the semen; (xxvi) carcinoma cells in sputum and pleural fluid. Section IV: Histology. (Editor: A. H. T. Robb-Smith.) (xxvii) Aspiration biopsy in general tumour diagnosis; (xxviii) cell counts in serial biopsies of carcinomata; (xxix) the lymph node biopsy; (xxx) the testicular biopsy; (xxxi) the endometrial biopsy; (xxxii) the skin biopsy; (xxxiii) the peripheral nerve biopsy; (xxxiv) the wet film technique in neurosurgery; (xxxv) the clinical and postmortem pathology of encephalitis; (xxxvi) routine diagnostic technique of the general morbid anatomist. Index.

This new volume takes a worthy place in the well-known series of Recent Advances in various branches of medicine and surgery which Messrs. J. & A. Churchill have now been publishing for many years. Clinical pathology may be defined as the study of disease in the living patient by laboratory methods, and during the past eight years in Britain there has been a remarkable extension of the laboratory facilities available to clinicians, and without doubt in the future many more diagnostic laboratories will be established. The production of this volume is therefore timely.

The book is divided into four sections under section-editors who have correlated the work on bacteriology, biochemistry, haematology and histology. The bacteriological section deals with the modern methods used in the diagnosis of most of the common infections; each chapter is designed to deal generally with a particular problem followed by details of the technical processes in common use and ending with a representative list of references which should prove useful as a guide to further reading. It would, of course, be extremely easy to compile a list of methods to which no reference is made. Each clinical pathologist who attempts to follow the literature of pathology and bacteriology prepares for himself a survey of laboratory methods and their significance which he finds particularly useful. In a book of this size there are bound to be omissions, but here there are surprisingly few, and all laboratory workers will find a large number of methods which they will be anxious to try for themselves and which will lead inevitably to greater efficiency in their laboratories. There is one notable omission which is perhaps regrettable—there is no chapter on the recent developments in the laboratory diagnosis of the common virus-diseases. The simple staining-methods, the serological technique, and the use of the common laboratory-animals in the diagnosis of the virus conditions met with in medical practice will have to take their place in routine laboratory work, and a book of this type would have been a useful vehicle for the dissemination of this knowledge.

The section on biochemistry opens with an excellent survey of liver-function tests which will be as valuable to the clinician as it will be to the pathologist. Another remarkable chapter summarizes our knowledge on the biochemical aids in the diagnosis of nutritional deficiencies. The list of references which conclude his cannot fail to prove extremely useful. Most pathologists will already be familiar, however, with Professor King's excellent book on microchemical methods, and the inclusion of some of these in the present volume might well have been omitted and the extra space used to amplify the chapter on blood-chemistry in renal and gastric conditions.

The section on haematology is perhaps the least satisfactory. Haematological nomenclature is still not uniform, but few pathologists will agree with the section-editor's description of the myeloblast, and drawings or photographs of the cells of the normoblastic and megaloblastic series would be useful in the next edition. The reader will wish that a chapter had been added on recent advances in the diagnosis of the haemolytic anaemias, on which a great deal of work has been done in the last ten years.

The section on histology is a mine of information for the pathologist. Among other chapters Dr. Robb-Smith contributes an excellent survey of work done on lymph-node biopsy. Professor Russell deals with her wet-film methods used on neurosurgical specimens, and Dr. Greenfield has written on the pathology of encephalitis.

Taken as a whole, this book is a notable contribution to the books on pathology published in Britain and there is no doubt that pathologists owe a debt to Dr. Dyke and to the European Association of Clinical Pathologists under whose auspices it has been published.

H. B. M.





## DENTAL SCIENCE AND TECHNOLOGY

1157 *Special or Dental Anatomy and Physiology and Dental Histology, Human and Comparative Vol. II*

T. W. Widdowson. 7th Edition. London, Staples Press Limited, 1946. xx + 333 pages; 201 illustrations. 21 x 13 cm. £2 2s. [£2.1]

(i) Comparative dental anatomy (introduction); (ii) definitions of terms used; (iii) horny teeth; (iv) functions of teeth; (v) homologies and definitions of mammalian teeth; (vi) deciduous or milk teeth; (vii) attachments of teeth; (viii) the animal kingdom: fishes; (ix) amphibia or batrachia; (x) reptilia; (xi) aves—birds; (xii) mammalia: prototheria; (xiii) metatheria; (xiv) edentata; (xv) ungulata; (xvi) cetacea; (xvii) sirenia; (xviii) carnivora; (xix) rodentia; (xx) insectivora; (xxi) cheiroptera; (xxii) primates; (xxiii) the evolution of mammalian teeth; (xxiv) special characteristics of skulls, hooves and muscles of jaws, etc. Index.

"Widdowson" has long been the textbook for most students of dental anatomy. It now enters on its seventh edition further expanded, but Volume II with its emphasis on comparative dental anatomy changed the least. This latter part of the subject is rarely enthused over by the student and by many is regarded as outmoded. Some examining bodies have seen fit to curtail markedly the time given to it. The present text is in part guilty of a thwarting of the student's interest because of an uninspired cataloguing of the dentitions (together with the inevitable formulae) of the vertebrates. The keynote of the book is throughout a painstaking assembly of data and snippets of the views of workers in this field but it lacks a true digestion and integration. This is the more disappointing since comparative anatomy can do so much to give perspective to our dental studies of the human masticatory apparatus. To those who have sat at the feet of that doyen of comparative anatomists, Frederick Wood-Jones, this book of Widdowson's must always appear a very pedestrian effort, painstaking but uninspired. Nevertheless, while the inevitable examination continues to demand a smattering of understanding of the subject, the dental student will be grateful that in Widdowson he can find the answers to his immediate problems.

1158 *Dental Materia Medica, Pharmacology and Therapeutics*

Walter J. Dilling & Samuel Hallam. Third Edition. London, Cassell and Company Ltd., 1946. xvi + 360 pages. 19 x 12 cm. 13s. 6d. [£0.675]

(i) Introductory; (ii) antiseptics and disinfectants; (iii) astringents; (iv) antacids; (v) oral hygiene; (vi) caustics; (vii) bleaching agents; (viii) obtundents; (ix) mummifying agents; (x) treatment of infected root canals; (xi) haemostatics; (xii) counter-irritants; (xiii) vaso-constrictors; (xiv) local anaesthetics; (xv) surface anaesthetics; (xvi) central anodynes and analgesics; (xvii) hypnotics; (xviii) basal hypnotics; (xix) motor nervous depressants; (xx) cardiac and circulatory stimulants; (xxi) vaso-dilators; (xxii) respiratory stimulants (analeptics); (xxiii) drugs acting on para-sympathetic nerve-endings; (xxiv) drugs influencing the digestive system; (xxv) emetics; (xxvi) purgatives; (xxvii) intestinal astringents; (xxviii) intestinal sedatives; (xxix) vitamins; (xxx) hormones influencing metabolism; (xxxi) treatment of anaemias; (xxxii) treatment of syphilis; (xxxiii) treatment of malaria; (xxxiv) vaccine and serum therapy, antitoxins; (xxxv) temporary filling materials and protectives; (xxxvi) Plaster of Paris; (xxxvii) oral secretion and excretions; (xxxviii) poisons, symptoms and treatment; (xxxix) Dangerous Drug Acts, poisons rules.

The third edition of this textbook does not differ markedly from earlier editions. From the dental surgeon's point of view, there is much that comes rarely within his normal field of experience. In those matters wherein he is more intimately concerned, a more detailed treatment would have been welcomed. The newer anaesthetics, tri-chlorethylene and cyclopropane are cases in point.

Specific criticisms<sup>1</sup> are: "oz." [ounce] and "ʒi" [ounce] are not synonymous (p. 15). In [British] pharmacy the rule is to employ the Imperial system when the term ounce is used and the Apothecaries' system when the sign ʒi is used. Therefore in the case of solids, 1 ounce = 437.5 grains and ʒi = 480 grains, a difference of nearly 10%. One doubts if it is really advisable to use mercuric chloride as a mouthwash (p. 73). It is a dangerous poison, and safe substitutes, with greater antiseptic powers, are now available. Pages 80-83, the section on penicillin, does not accurately reflect our latest knowledge on the subject. For example, pure penicillin and even the impure forms are very stable if dry. As now supplied,

<sup>1</sup> [But the European reader may think that criticism might also, and possibly more usefully, be directed at the retention of these systems of measurement.—Ed.]

there is no necessity to keep it in a refrigerator. Investigations show that there is no perceptible loss of potency even after many months' storage at ordinary temperature. Other preparations, if no water is present, are equally stable. The pastilles with a glyco-gelatin base are unstable and have been replaced by the lozenges, of which no mention is made. In dental practice the 50-unit lozenges are becoming very much in demand as a prophylactic measure before and after extraction. One rightly expects to find comments on their use and a possible criticism of their low strength. They are official in the British Pharmacopoeia.

Numerous other criticisms arise which cause one to feel that the dental facet of this volume is uncritical and in part ill-informed.

1159 *The Chemistry and Metallurgy of Dental Materials*

J. Campbell Smith. Oxford, Blackwell Scientific Publications Ltd., 1946. vi + 317 pages; 60 figures. 22 x 15 cm. £1 1s. [£1.05]

Part I: Metals and Alloys. (i) Properties of metals, crystalline structure, space lattice; (ii) mechanical properties, tensile strength, elasticity, ductility, malleability, hardness; (iii) deformation of metals, slip bands, fatigue, hot and cold working, annealing, hardening; (iv) cast metal, ingots, crucibles, furnaces, pyrometry; (v) metallography, polishing, etching, micro-examination; (vi) theory of alloys, cooling curves, constitutional diagram, eutectic alloy; (vii) theory of alloys continued, solid solution diagrams; (viii) metals used in dentistry. Gold. Amalgamation, cyaniding, quaternary, cupellation, wet assay, recovery, fluxes. Properties of gold, gold foil, colouring, electroplating; (ix) dental casting, investing, melting, casting machines; (x) gold alloys, calculations. Alloys with silver, copper, platinum, palladium, nickel; (xi) cast, clasp, and wrought golds, swaging, dies, and counterdies; (xii) heat treatment of dental gold alloys; (xiii) theory and practice of soldering, fluxes, blowpipe; (xiv) platinum group metals, silver, photography, mercury; (xv) dental amalgams, silver tin diagram, amalgam alloys, ageing, amalgamation; (xvi) amalgams, continued. Dimensional changes, packing, finishing, micro-structure, copper amalgams; (xvii) properties and alloys of copper, lead, tin, bismuth, antimony. Fusible alloys; (xviii) chromium, aluminium, iron; (xix) steel, thermal treatment, hardening, tempering; (xx) electro-deposition. Corrosion; (xxi) anti-corrosive metals, stainless steel; (xxii) stainless steel attachments, soldering, welding; (xxiii) nickel, cobalt, manganese, zinc, cadmium, magnesium, alkali metals. Part II: Inorganic Materials other than Metals. (xxiv) Boron, silicon, refractory materials; (xxv) dental casting investments; (xxvi) dental cements, zinc oxychloride, zinc oxyphosphate, silicate. Compositions, setting, pulp irritation; (xxvii) dental porcelain, composition, condensation, firing; (xxviii) impression materials, plaster of Paris, setting, accelerators and retarders, casts, models; (xxix) other impression materials, rigid, plastic, elastic, quick setting stone, impression paste, hydro-colloidal materials, trays; (xxx) abrasives, dentifrices. Part III: Organic Materials. (xxxi) Rubber, vulcanization, synthetic rubbers; (xxxii) dental plastics, classification, chemistry of polymerization, acrylic resins, preparation, properties, processing; (xxxiii) waxes; (xxxiv) anaesthetics, inhalation, basic, local, novocaine and its analogues, adrenaline; (xxxv) pH value, buffer solutions, hypo-, iso-, and hypertonic solutions; (xxxvi) antiseptics and disinfectants; (xxxvii) organic chemistry. Hydrocarbons, halogen derivatives; (xxxviii) alcohols, ethers, aldehydes, ketones; (xxxix) fatty acids, acyl chlorides; (xl) unsaturated hydrocarbons, nitrogen and sulphur compounds; (xli) carbohydrates, sugars, starch, cellulose; (xlii) aromatic compounds, benzene and its derivatives, phenols, acids. Essential oils. Index.

One of the recent developments in dental education is the introduction in many dental schools of a course in the science of dental materials. The content of such a course is variable, and therefore the text-books designed to cater for such a course will necessarily show considerable variation of treatment. Doubtless, the present book was intended to meet the needs primarily of students at the Edinburgh Dental Hospital. Inevitably, the fact that the author is not a dental surgeon exposes him to the danger of a lack of perspective in the handling of the subject. In the reviewer's opinion this lack of perspective exists. A section on pure organic chemistry of 60 or more pages seems out of place. It is impossible to treat a subject like this adequately in 60 pages and to proceed, as the author does, from a definition of organic chemistry to the structural formula of chloro-6-hydroxy-3-toluene. In these days one has a right to presuppose an elementary knowledge of both organic and inorganic chemistry. Furthermore, it is extremely questionable whether the dental student is really helped by knowing the structural formulae of a number of unrelated therapeutic substances. The section on dental cements, impression materials, casting alloys, etc., contains much useful information and indicates many recent developments of knowledge in these fields. Nevertheless, there is a scrappiness of treatment, a lack of cohesion about this book which compels the reviewer to withhold from it the hall-mark of a first-class textbook. Several errors of spelling and, more important, of fact, occur in the text.

E. Matthews

## 1160 The Dental Assistant's Handbook

G. I. West. London, William Heinemann (Medical Books), Ltd., 1946. 108 pages; 25 illustrations. 19 x 12 cm. 6s. [£0.3]

(i) Introductory; (ii) surgery duties and sterilisation; (iii) psychological approach to patients; (iv) dental hygiene; (v) conservative work; (vi) the anatomy of teeth; (vii) dental radiology; (viii) anaesthetics—local and general; (ix) dental instruments and their care; (x) common dental diseases and abnormalities; (xi) mechanical work; (xii) dental formulae. Appendix. Index.

This is an excellent little book, full of commonsense in relation to the everyday problems that beset the dental assistant, i.e. dental nurse. As Miss West truly says, "A good assistant is the mainstay of a dental practice". Miss West emphasises the sense of responsibility that any good assistant must bear, both in relation to the patient and to her principal. If criticism there be of this book, it is that in parts it is likely to be too technical for the beginner. There would seem, for instance, to be little need for the inclusion of a description of such pathological conditions as epulis and ranula. Naturally, the treatment is in many respects superficial, and the suggestion that pyorrhoica is caused by an amoeba is unwarranted.

One deplores the advice given on page 32, that the assistant should complete her mixing of amalgam by doing so in the hand for 1 minute. Not only does such handling affect the setting-expansion and strength of the resulting amalgam-filling, but the risk of toxic absorption of mercury is a real one. This latter risk is recognized on page 78, where Miss West comments on the factors leading to mercurial stomatitis.

If, as seems inevitable, there is to be a great increase in the numbers of dental assistants, with the possibility of the scope of their work increasing on the lines of the dental hygienists trained by the RAF, then this little book, further expanded in a subsequent edition, will be found to be indispensable.

E. Matthews

## DERMATOLOGY

### 1161 Practical Handbook of the Pathology of the Skin

J. M. H. MacLeod & I. Muende. Third Edition. London, H. K. Lewis & Co. Ltd., 1946. xix + 415 pages; 152 illustrations. 24 x 16 cm. £2 10s. [£2.5]

(i) Biopsies; (ii) methods for the histological examination of skin material in the fresh state; (iii) methods of preserving skin material for histological examination; (iv) methods of imbedding skin material and of cutting and preparing sections for staining; (v) general principles of staining skin; (vi) the cell and its mode of reproduction, and the method of staining the cell in general; (vii) the superficial architecture of the skin, the embryology of the skin as a whole, and a note on the development of the epidermis; (viii) the epidermis; (ix) the epidermis (continued); (x) pathological changes involving the epidermis; (xi) pathological changes involving the epidermis (continued); (xii) pathological changes involving the epidermis (continued); (xiii) pathological changes involving the epidermis (continued); (xiv) pathological changes involving the epidermis (continued); (xv) the corium; (xvi) the corium (continued); (xvii) pathological conditions of the corium; (xviii) pathological conditions of the corium (continued); (xix) pathological conditions of the corium (continued); (xx) pathological conditions of the corium (continued); (xxi) hair; (xxii) pathological affections of the hair and the hair-follicle; (xxiii) the sebaceous glands; (xxiv) the sweat-glands or coil-glands; (xxv) the muscles of the skin; (xxvi) the blood-vessels of the skin; (xxvii) the blood in skin diseases and skin eruptions associated with affections of the blood-forming tissue; (xxviii) the lymphatics of the skin; (xxix) the nerve-terminations in the skin; (xxx) lipides of the skin; (xxxi) the pigment of the skin; (xxxii) bacteria and the bacteriology of the skin; (xxxiii) the bacteriology of the skin; (xxxiv) bacteria and the bacteriology of the skin; (xxxv) bacteria and the bacteriology of the skin; (xxxvi) bacteria and the bacteriology of the skin; (xxxvii) bacteria and the bacteriology of the skin; (xxxviii) bacteria and the bacteriology of the skin; (xxxix) bacteria and the bacteriology of the skin; (xl) bacteria and the bacteriology of the skin. Index.

There are only a few slight changes in this edition. The second edition was published in 1940 and was exhausted four years later. It is not surprising that this book has been in great demand both by dermatologists and general pathologists. Text-books on general pathology and on morbid histology usually ignore the skin except for its tumours, and pathologists have long needed the help of such a book in reporting on the occasional specimens of skin sent to them.

Descriptions of histological technique are given fully and include methods of fixing and hardening specimens and a large range of staining-techniques. The histological changes found in the various dermatoses are dealt with more briefly. They will be of great help to a dermatologist in his early years, but are not intended to be used in the elucidation of difficult problems met in attempting to differentiate between rarities.

The book starts with an account of the performance of a biopsy and the details of the technique of preparing and staining a section from it. This is followed by a description of the epidermis and of its pathological changes. The corium and its disorders are then described. Next the appendages, vessels, nerve-endings, blood, fat, and pigment are dealt with similarly. The closing chapters contain an account of the vegetable and animal parasites of the skin. The excellent section on dermatophytes contains a useful table of the "common ringworm fungi" and an account of the appearances and diagnostic characteristics of the fungi both on direct examination and on culture.

The illustrations, both coloured and black-and-white, are profuse, clear, well chosen, and splendidly reproduced. I suggest that one of neurofibroma should be included in the next edition.

Other minor improvements which could be made in subsequent editions are:—(i) mention should be made of the presence of mucin in granuloma annulare; (ii) the histology of poikiloderma should be described; (iii) some account should be given of stasis dermatitis to help in differentiating it from Schamberg's disease and from Majocchi's purpura annularis telangiectodes.

The print, format, and binding are excellent. The quality of the paper is a marked improvement on that of the second edition. The style is simple and unambiguous. This is a good book and can safely be recommended.

E. Lipman Cohen

### 1162 Diseases of the Skin

James H. Sequeira, John T. Ingram & Reginald T. Brain. Fifth Edition. London, J. & A. Churchill Ltd., 1947. xii + 782 pages; 443 illustrations. 23 x 15 cm. £3 3s. [£3.15]

Introduction. (i) The normal skin, histology and physiology; (ii) morphology of skin diseases. Group I. Congenital abnormalities of the skin. (iii) Congenital abnormalities of the skin. Group II. Dermatoses of internal origin. (iv) Cutaneous affections in general. (v) Circulatory disorders, vascular an. . . . of the skin. Group III. Constitutional . . . . (vii) neuro-dermatoses; (ix) lichen planus; (x) alopecia, leucoderma, scleroderma, dermatomyositis; (xi) the scabrous dermatoses; (xii) pityriasis rosea, psoriasis, keratoderma blenorrhagica, para-psoriasis; (xiii) toxic eruptions, including the erythema; (xiv) erythrodermia and generalised exfoliative dermatitis; (xv) eruptions due to drugs. Group IV. Dermatoses due to external irritants. (xvi) Dermatoses due to mechanical and physical agents; (xvii) dermatoses due to chemical irritants; (xviii) occupational dermatoses and their medico-legal significance. Group V. Infective dermatoses. (xix) Affections caused by animal parasites; (xx) affections caused by vegetable parasites; (xxi) acute bacterial infections of the skin; (xxii) chronic bacterial infections of the skin; (xxiii) chronic bacterial infections of the skin (continued); (xxiv) chronic infective diseases of the skin; (xxv) chronic infective disease of the skin (tropical); (xxvi) virus diseases of the skin; (xxvii) dermatitis herpetiformis, pemphigus. Group VI. Atrophic and hypertrophic dermatoses, tumours of the skin. (xxviii) Atrophic conditions of the skin including ainhum; (xxix) hyperplasia and tumours. Group VII. Diseases of the appendages of the skin. (xxx) Affections of the sebaceous glands, hair follicles and sweat glands; (xxxi) diseases of the nails. Appendix I. Principles of general treatment and formulae. Appendix II. Principles of local treatment and formulae. Appendix III. Principles of physiotherapy.

Dr. Sequeira has had the assistance of two of his former pupils in preparing the 5th edition of his excellent textbook. The brief introduction sets the tone of the whole work—dermatology is closely related to general medicine, and "the psychological field" is of great importance in the behaviour of the skin. The other especially noticeable characteristic of the book is the lack of stress laid on allergy; this is a welcome change from those works which imply that an understanding of allergy is the most important requisite for the practice of dermatology. After a chapter on the normal skin and a helpful account of the morphology of skin-diseases, including twenty-one wise aphorisms, the rest of the book is divided into seven "groups" on the various dermatoses. Throughout, the descriptions of diseases and their diagnoses are clear and the sections on treatment are full, practical and really useful. The black-and-white figures are excellent, but some of the coloured plates could be improved. References are lamentably scanty.

The difficult subject of eczema receives unusually clear treatment without mentioning allergy. As elsewhere in the book, terminological muddles are avoided. It is a pleasure to see Besnier's prurigo described as such; "atopic dermatitis" is not mentioned. The only confusing name which has been retained is "white spot disease".

The three chapters on Dermatoses due to External Irritants are noteworthy. They include long lists of occupations, plants and external applications with accounts of the dermatoses which may result from them. The separate chapter on the medico-legal significance of the occupational dermatoses is unusual and

helpful. Tropical dermatoses are dealt with more fully than usual and are well illustrated. Syphilis receives seventy pages including three on prophylaxis. Treatment is described fully both with and without penicillin, and includes intensive courses.

There are three appendices—on general treatment, local treatment, and physiotherapy. A large number of useful prescriptions is given. Emulsion-bases are described and discussed. The principles of radiotherapy are given clearly and sufficiently. There is an index of 94 pages.

New editions are certain to be required, and in them certain minor changes should be made—the myth that acne rarely lasts beyond the twenty-fifth year should be allowed to die; “ephelis” and “lentigo” should not be regarded as synonymous; reference to the Pastille method of measuring x-ray dosage should be omitted. A satisfactory classification of skin diseases has never been devised, but the arrangement of parts of this book seems to be rather strained.

This book can be recommended confidently to students and practitioners. Dermatologists will enjoy reading it and will appreciate the practical sanity of its outlook. The print, paper, binding and appearance are excellent.

E. Lipman Cohen

## 1163 An Introduction to Dermatology

Norman Walker & G. H. Percival. Eleventh Edition by G. H. Percival. Edinburgh, E. & S. Livingstone, Ltd., 1947. xii + 349 pages; 233 illustrations. 22 x 14 cm. £1 15s. [£1.75]

... classification, diagnosis, (v) the urticarias; (vii) eczema and dermatitis—I; (viii) eczema and dermatitis—II; (ix) avitaminosis; (x) psoriasis, pityriasis rosea, lichen planus, pityriasis rubra pilaris, generalised exfoliative dermatitis; (xi) superficial bacterial infections and vaccinias; (xii) diseases due to animal parasites; (xiii) diseases due to vegetable parasites—I; (xiv) diseases due to vegetable parasites—II; (xv) infective granulomata; (xvi) tropical skin diseases; (xvii) the reticuloses; (xviii) disorders of the skin appendages—I; (xix) disorders of the skin appendages—II; (xx) disorders of the skin appendages—III; (xxi) dystrophic cutaneous disorders; (xxii) anomalies of sensation; (xxiii) benign cutaneous tumours; (xxiv) malignant cutaneous tumours.

Professor Percival collaborated with the late Sir Norman Walker in writing the 10th edition of this book. He has completely rewritten this edition and it is virtually a new book. It is an individual work and differs markedly in outlook from most other modern books on the subject. The approach is strongly morphological—“To diagnose a skin disease it is first necessary to determine what is the characteristic primary lesion.” The histology is given for most of the conditions described. The macroscopic and microscopic descriptions of the various diseases provide the best sections of the book. Reference is rarely made to the patient who is almost ignored—“The history of a case of skin disease as obtained from the patient is of little importance except when it is confined to simple facts.” Psychogenic factors receive extremely slight attention. The sections on topical applications are very good. On the other hand there is little suggestion of a close relationship between dermatology and general medicine—“in the vast majority of skin diseases the cause is located in or on the skin itself”.

Of the twenty-four chapters the first three are of a general nature and the rest deal with the diseases of the skin. The chapter on treatment refers exclusively to details of external treatment—“in the majority of cases the most important form of treatment is the direct application of remedies to the diseased area . . .”. This section is extremely helpful. The exact method of use of the various applications is described in full and is well illustrated. Many useful prescriptions are given and stress is laid on the value of starch-poultice, exact details being given for its preparation and mode of application to different parts of the body. Eczema and Dermatitis receive two chapters in which the nomenclature differs from the usual British custom—“it has been decided to use the term Eczema to indicate all those cutaneous eruptions presenting the eczematous type of dermatitis in its various forms”. “On the other hand the term Dermatitis is restricted to examples of simple inflammation of the skin which present no distinctive feature of form or course . . .”. Seborrhoeic dermatitis is regarded as a variety of infective eczema called “eczematide”—this is in line with the writings of French dermatologists. Besnier's prurigo also is regarded as a variety of eczema.

Throughout the rest of the book the arrangement and classification are as good as have ever been found. All descriptions are concise, but those relating to symptomatology, histology and external treatment are very clear. The paragraphs on etiology are less helpful, though allergy is treated with reasonable proportion. The most surprising statement is that the Seneur Usher syndrome is identical with Pemphigus Foliaceus. The prognosis is given of each disease, acne being regarded unduly optimistically. Rarities are rightly ignored in a book of this size, and the relative amount of space given to the various dermatoses is well balanced except in two instances—leprosy receives more space than syphilis, and purpura deserves fuller treatment. No references are given. There is a good index.

The outstanding feature of the book is the excellent illustrations. These are profuse, admirably chosen, and clear. The unusually large number in colour are most satisfactory. As is to be expected in a work by Professor Percival, there are many first-rate photomicrographs. The print, paper, and binding are good. The book is exceptionally easy to handle.

E. Lipman Cohen

## DISEASE IN CHILDHOOD

### 1164 Child Health

Edited by Alan Moncrieff & William A. R. Thomson. London, Eyre and Spottiswoode (Publishers) Ltd., 1947. 254 pages. 21 x 14 cm. 14s. [£0.7]

(i) Introduction: child health and the general practitioner; (ii) the organization of child welfare; (iii) the child health service; (iv) the toddlers' clinic; (v) the child health service; (vi) the work of the school health service; (vii) the campaign against juvenile rheumatism; (ix) the diagnosis and management of mental deficiency; (x) the child guidance clinic; (xi) care of the new-born baby; (xii) tuberculosis in childhood; (xiii) venereal disease services; (xiv) the deaf child; (xv) the blind child; (xvi) the care of the crippled child; (xvii) physical education and the health of the child; (xviii) the control of the common fevers of childhood; (xix) breast feeding; (xx) artificial feeding of healthy infants; (xxi) “mixed feeding”; (xxii) diet and the school child. Index.

This small book is important, in the information it gives, and also in the implications and issues of policy it raises. It is therefore welcome both in what it achieves, and for the wider objectives it opens out. Under the title *Child Health*, it is a detailed and practical outline of the work of the many organizations dealing with infant- and child-care, written in each case by the medical officers engaged in these activities. These agencies include not only the “preventive” clinics of the child-welfare and school-health services, but also the “curative” clinics dealing with tuberculous, rheumatic, crippled, mentally-defective, and other types of handicapped children. The articles first appeared in *The Practitioner*, and now after suitable adjustment, and supplemented by an additional group of four articles on food and diet in infancy and childhood, are gathered into the present volume under the editorship of Professor Moncrieff and Dr. Thomson under the comprehensive title of *Child Health*.

There have been many theoretical discussions of what *Child Health* is, or ought to be; and of its policy. Here in this book we have an account of what is being actually done by organized medical and nursing services to safeguard the health of children. The account is written by men and women engaged in the conduct of these services, and is permeated by a critical and moderate spirit. Such an authoritative account of what is being done today in the field of *Child Health* must be of value, showing what is good, and not hiding what is faulty. After reading these many papers, some general impressions may be given. One is of the satisfactory gradual extension of the supervision of infants to the years between one and five so that the whole life of childhood before and during school is now coming under a continuous survey in clinics. Another is of the established and growing popularity of the preschool clinics among mothers. A third impression is of the enormous mass of minor defects and disorders discovered and successfully dealt with by these clinics and of the great contribution made thereby to the better health of infants and children.

What of the future development of this work? So far as the diagnostic and remedial parts are concerned, it is evident that

an elaborate and successful machine has been built up; and in the future, nothing better is likely to replace it. But the work has also its educational side, moving towards the eradication of these innumerable blots and blemishes in child life; and here there is a general feeling, expressed in this book, in official reports, and in the new National Health Service Act, that the final goal of radical prevention will be more quickly reached by setting up within the home a service of education under the aegis of the home doctor (the family practitioner) and the health-visitor. For it is within the home—in its physical conditions, and in the personal aptitudes of the mother—that the laws of child health are seen in operation; and it is the degree of observance paid to these laws within the home that determines the issue of health or disease in the child. It is widely realized, therefore, that the new national medical service brings to the general practitioner an opportunity of making an important contribution to child health. These implications and ideals and their practical fulfilment are discussed in the opening chapter of the book by Sir Leonard Parsons. In a judicial and comprehensive survey, he discusses the present position of the child-health services, and the present and future position of the general practitioner with regard to them. But it should be made clear that in the future the general practitioner may participate in this field of preventive child-medicine in two ways, by taking a share in the existing child clinic-services, and by advising mothers and supervising children in their homes.

It will thus be seen that the book under review deals with a medical problem of national importance and is a valuable contribution to the problem. It gives an authoritative survey of the organized services in the field of child health. It also raises important issues of future policy which are of particular concern to the general practitioner.

Charles McNeil

## 1165 Diseases of Children

Edited by Sir A. E. Garrod, Frederick E. Batten & Hugh Thursfield. Fourth Edition edited by Donald Paterson & Alan Moncrieff. Vol. 1. London, Edward Arnold & Co., 1947. xi + 771 pages; 154 illustrations. 23 x 14 cm. £1 10s. [£1.5]

Part I. General considerations. (i) Heredity; (ii) vital statistics and administrative aspects; (iii) growth and development; (iv) the use of drugs in infancy and childhood; (v) clinical pathology; (vi) water and electrolyte control and acid-base regulation; (vii) nutrition, protein and toxæmia; (viii) practical procedures; (ix) anaesthetics in the surgery of children; (x) the feeding of infants and children. Part II. Diseases of children. (xi) The newly-born baby; (xii) diseases of nutrition; (xiii) disorders of metabolism; (xiv) diseases of the ductless glands; (xv) disorders of the alimentary system; (xvi) congenital defects of the alimentary tract; (xvii) diseases of the alimentary tract; (xviii) diseases of the nose, pharynx, larynx and ears; (xix) diseases of the respiratory system; (xx) tuberculosis; (xxi) allergy. Index.

We welcome a new edition of this well-known British textbook after an interval of 13 years. Advances in paediatrics during this period have been so extensive that much revision has been necessary, and many sections have had to be entirely re-written. The resulting increase in the amount of subject-matter has necessitated division of the book into two volumes. Volume I, which is now published, deals in the first place with matters of general consideration. At the present time when the importance of child-health is being stressed and emphasized, the chapter on vital statistics and administrative aspects is most opportune. Dr. Charles reviews in an able and lucid manner the statistical background leading up to present knowledge, he outlines briefly the origins and development of the Child Welfare Services, and points out some of the problems that have yet to be solved. The newborn baby and diseases of nutrition, and the alimentary and respiratory systems, are considered in the second part of this volume. There is a very useful chapter on practical procedures, including parenteral administration of fluid, lumbar and cisternal puncture, artificial respiration, etc. Throughout the book an even balance of the various subjects and diseases is maintained, and the re-duplication, inevitable and not always undesirable in any book of this character, has been kept within reasonable proportions. There is a good selection of photographs, diagrams and illustrations, and references to current literature are given at the end of each chapter.

As an exposition of current British teaching and practice this book can be confidently recommended, for both students and practitioners.

J. M. S.

## 1166 Diseases of Children's Eyes

James Hamilton Doggart. London, Henry Kimpton, 1947. xvi + 288 pages; 210 illustrations. 24 x 16 cm. £2.2. [£2.1]

(i) General principles of examination; (ii) anatomy of the orbit; (iii) the eyeball; (iv) the eyelids. Conjunctiva. Lacrimal apparatus. Extrinsic ocular muscles, and Tenon's capsule; (v) the visual pathway and other nervous connections of the eye and its adnexa; (vi) development of the eye and its adnexa; (vii) developmental errors of the whole eyeball and of structures in close anatomical relation thereto; (viii) congenital abnormalities of individual structures of the eyeball accessible to external examination; (ix) congenital abnormality of intra-ocular structures not visible by external examination; (x) ocular complications and sequelae of disease elsewhere; (xi) methods of treatment; (xii) ocular welfare; (xiii) injuries of the eyeball; (xiv) diseases of the orbit; (xv) refraction; (xvi) disordered movement; (xvii) incomitant squint; (xviii) concomitant squint; (xix) heterophoria and convergence defect; (xx) nystagmus; (xxi) lacrimal disorders; (xxii) disorders of eyelids; (xxiii) diseases of the conjunctiva; (xxiv) phlyctenular disease; (xxv) diseases of the cornea and sclera; (xxvi) the anterior chamber; juvenile glaucoma; (xxvii) diseases of the lens; (xxviii) diseases of the vitreous; (xxix) diseases of the neural tract; (xxx) hereditary and familial disorders of the retina; (xxxi) other retinal disorders; (xxxii) diseases of the optic nerve. Index.

Ophthalmology of childhood has features which sharply distinguish it from ophthalmology in general. Childhood is greatly troubled with many congenital and genetic anomalies. The refraction of the eye changes markedly during the early years of life. Affections such as ophthalmia neonatorum, squint, phlyctenular ophthalmia, interstitial keratitis, spring catarrh and retinoblastoma fall particularly heavily or exclusively on childhood, and each of these affections illustrates a variety of pathological states to which the child is specially prone. In contrast, the abiotrophics are of little significance in childhood, and this also applies to iritis, cataract, and glaucoma, the major plagues of the adult and ageing individual. Physiologically and clinically, the eye and its adnexa show both considerable post-natal development and extensive senile degenerative changes, so that the field for a survey of eye-affections as seen in childhood is therefore fairly well defined, especially as the post-natal developments dictate a variety of pictures that differ from each other in the different periods of childhood.

So far no study of ophthalmology in childhood has appeared and Mr. Doggart is to be complimented on venturing on a task that must have appealed to many, who have felt baulked by the difficulties. The opening chapters of this treatise cover briefly but adequately anatomical, physiological and embryological considerations. The remaining chapters include, apart from the usual textbook classification, chapters on ocular complications of general disease and on methods of treatment. The chapters dealing with ocular muscle-imbalance are particularly good and full. The teaching is orthodox and well presented.

## 1167 Skin Diseases in Children

George M. MacKee & Anthony C. Cipollaro. Second Edition revised and enlarged. London, Hamish Hamilton Medical Books [1946]. xviii + 448 pages; 226 illustrations. 24 x 16 cm. £1 17s. 6d. [£1.875]

(i) The care of normal skin; (ii) diseases in which pyogenic bacteria are important etiologic factors; (iii) diseases due to fungi; (iv) diseases due to animal parasites; (v) the erythema group; (vi) the erythema group medicamentosa (drug eruptions); (x) scaling dermatoses and the lichens; (xi) benign and malignant new growths; (xii) allergic diseases; (xiii) diseases of the skin and mucous membranes; (xiv) diseases; (xv) syphilis in children. Index.

A second edition of this book (undated) has appeared with contributions from other American dermatologists. The preface states that the book is intended for the general practitioner and is therefore "essentially practical". This means in effect that little attempt is made at any general scientific approach to dermatological questions, and that the description of a disease is often a dreary list of unexplained symptoms. There are a number of points which might with advantage be clarified in any future editions. On page 78 it is stated that "... skin testing of patients with infantile eczema has been of much greater service in differential diagnosis than as a therapeutic aid." On the next page it is admitted that "... atopic individuals may be able to tolerate foods which elicit positive reactions, and it is also true that foods which fail to elicit reactions may nevertheless be responsible for



clinical symptoms." In this case, what aid to diagnosis has been afforded by the tests? Sulphathiazole ointment is recommended for impetigo and ecthyma on pages 20 and 23. The danger of sensitization is only briefly mentioned on page 71. Again, rosacea is grouped under the heading "Diseases involving pyogenic bacteria", and it is then said that "The most common cause of rosacea, perhaps, is the ingestion of stimulants . . ." Later it is added that there is often a vitamin-deficiency, a theory not borne out by the work of Fish.

In dealing with the treatment of diseases, this book shares with many other textbooks a depressing tendency to vague and woolly statements. For example, with regard to the treatment of furunculosis we read on page 25: "The various remedies that have been advocated as more or less specific (calcium sulfide by mouth, the arsenicals by ingestion or injection, mercury and calcium by injection, yeast, stannoxyl, turpentine, etc.) have been found of little value by those who have had sufficient experience, except, of course, when they are specifically indicated as a result of laboratory investigation." Now if the patient has syphilis, or anaemia, or calcium-deficiency, naturally he needs treatment, but apart from specific diseases what kind of laboratory investigation indicates the need for stannoxyl, turpentine, etc.? Chilblains are to be treated by " . . . attention to the general health . . ." Grey hair receives the same recommendation. As an "essentially practical" approach to the general practitioner I would like to suggest that we should all of us employ a recognized abbreviation for the following:—"The cause of this condition is largely (or entirely) unknown; in consequence, treatment is empiric and largely unsuccessful. Your guess is as good as another's." A famous President of the United States made some historic remarks about the difficulty of fooling all of the people all of the time. In deference to him, I suggest that we replace the above by "Verb. sap. Linc."

The book contains a useful inclusion on contagious diseases in childhood. There is an excellent chapter by Dr. Eugene Traub on congenital cutaneous anomalies. And the illustrations, with very few exceptions, are extremely good and helpful.

A. C.

## ENDOCRINOLOGY

### 1168 Recent Advances in Endocrinology

A. T. Cameron. Sixth Edition. London, J. & A. Churchill Ltd., 1947. vii + 443 pages; 74 illustrations. 21 x 14 cm. £1 ls. [£1.05]

(i) Introduction; (ii) the thyroid gland; (iii) disease states associated with abnormal thyroid function; (iv) the parathyroid glands; (v) the islets of Langerhans and insulin; (vi) the steroid hormones and related compounds; (vii) the adrenal glands; (viii) the endocrinology of reproduction; (ix) the pituitary glands; (x) diseases correctly and incorrectly associated with hypofunction of the anterior pituitary; (xi) gigantism and acromegaly; (xii) Cushing's disease and the adrenocortical syndromes; (xiii) some other hormones and some related problems. Index.

Professor A. T. Cameron's books on biochemistry in its various phases have proved to be of the very greatest value to both medical students and their teachers. His *Textbook of biochemistry* is undoubtedly one of the best balanced works on the subject, and as an interpreter of the part played by biochemistry in biological and medical science he is perhaps without equal.

His contributions to the Recent Advances series has been equally notable and the present sixth edition of his *Recent advances in endocrinology* is precisely what we should expect from this author. The book covers the whole field of endocrinology, but it is obvious of course that the author is mainly interested in the chemical side. The rough plan which is followed throughout the book is that one chapter or section is devoted to each gland and the various hormones produced by it. The chapters are again sub-divided, the first sub-division dealing with the histological structure of the gland, the chemical nature of its secretions and its function in the normal human or animal body. The subsequent sub-divisions are devoted to the pathological states that arise through hyper- or hypofunction of the gland, the differentiation between the various symptom-complexes, and the appropriate methods of treatment.

In chapter 6 a general review of the steroid compounds is given,

including not only the hormones of the adrenal cortex and the gonads but also the chemically-related sterols and vitamins D. A list of these compounds is given with their formulae, chemical names, the substances from which they have been isolated and the nature and extent of their biological activity.

The last chapter deals with the actual and presumptive hormones of the gastro-intestinal tract, the thymus and pineal glands, other suggested hormones and antihormones. The final section of this chapter emphasizes once again, as is done throughout the book, the close interrelationship existing between the various endocrine glands.

The documentation is excellent and is as up-to-date as possible. The volume can be used both as a textbook and as a work of reference. The complications of endocrinology are notorious, and of all subjects upon which it would be possible to write an incomprehensible textbook, endocrinology is certainly one. Professor Cameron has not only written a comprehensible work but a thoroughly readable volume. This is no mean achievement and one on which the author should certainly be congratulated.

E. C. Dodds

### 1169 Leitfaden für Zuckerkrankhe

Georg R. Constam. Basel, Benno Schwabe & Co., 1947. 127 pages; 15 figures. 22 x 16 cm. sw. fr. 12.50

(i) Einleitung; (ii) das Wesen der Zuckerkrankheit; (iii) Ursachen der Zuckerkrankheit; (iv) Prophylaxe der Zuckerkrankheit; (v) die ersten Zeichen der Zuckerkrankheit; (vi) Verlauf der Zuckerkrankheit; (vii) Ziel und Prinzip der Behandlung; (viii) Technik der Harnuntersuchung; (ix) die Ernährung der Zuckerkranken; (x) Insulinbehandlung; (xi) andere "Heilmittel" gegen Zuckerkrankheit; (xii) Behandlung des Diabetes durch Operationen; (xiii) Koma diabeticum; (xiv) Komplikationen der Zuckerkrankheit; (xv) Zuckerkrankheit und Schwangerschaft; (xvi) Schlusswort; (xvii) Anhang. Sachregister.

The number of small books written for diabetic patients by doctors running diabetic clinics is legion in number and in form. The present swiss book under review seems to be the best ever produced in the german tongue in its thoroughness, clarity and humanity. The author is optimistic and hearty, and tells the diabetic reader that he can lead a normal life and can "hold his head high". He then proceeds in great detail to show the reader how this can be done, and includes all the usual sections of such a work—details of diet and admirable food-tables for a weighed and varied diet; the nature of diabetes, the action of different insulins, the use and care of the syringe, the necessary urine-tests; the complications of coma, foot-troubles and how to avoid them, and so on.

I wonder if the book, 126 large pages and produced with such good paper, print and illustrations as is impossible in post-war England, does not fall between two stools? Too much detail for the patient, and not quite enough to make it instructive to the doctor, nor enough to let the patient treat himself. Two pages on the differential diagnosis of coma seem out of place for the comatose patient or even his relatives. Hence the book goes in for greater detail, of doubtful value for the patient, than Lawrence's *Diabetic ABC* or the american books of Joslin or Wilder.

The diet-tables are all-inclusive and very well arranged. They give the weights of food-stuffs containing 10 grams of carbohydrate, protein and fat, and are thus arranged on the basis of the english system instead of the american percentage system. But a further column includes the percentages, very clear to the scientist but of doubtful value to the average patient. The source of the food-values is not mentioned, and the contents given vary considerably from the analyses of McCance & Widdowson used in Britain. It is difficult to make out the calorie-value of the diets advised (calories are hardly mentioned) or the different levels of carbohydrate and protein used.

As regards urine-tests, it is good to know that Benedict's test for sugar is ousting Nylander, Trommer and even Fehling's test, but it seems a pity that, for ketones, Rothera has not replaced Legal. It is impractical, too, to recommend the boiling of insulin-syringes instead of keeping them in 70% alcohol and so making a process of 20 minutes instead of 1. This is a minor criticism of a best book of its kind in the german language. There is nothing new in it for doctors, but it is practical, clear and helpful to the abetic for whom it was written.

R. D. L.



## FOODS

## 1170 Food and Health: An Introduction to the Science of Nutrition

A. Barbara Callow. Third Edition. Oxford, Clarendon Press, 1946. viii + 184 pages; 9 figures. 19 x 12 cm. 6s. [£0.3]

(i) Chemistry and nutritive value; (ii) digestion; (iii) food as fuel; (iv) vitamins and their history; (v) scientific standards for diets; (vi) the choice of food; (vii) everyday meals; (viii) diets for mothers and children; (ix) diets for special cases; (x) food habits and dietetic systems. Tables. Literature list. Index.

To write a book which is to be both intelligible to the lay reader and at the same time useful to the medical student, nurse, and dietician is a considerable task. Miss Callow has accomplished it in 146 pages (excluding tables, etc.) which are delightfully easy to read and which contain much sound practical advice. Beginning with a very simple account of the chemistry and nutritive values of the proximate dietary principles, the author takes us rapidly along the digestive tract to a consideration of food and the scientific principles upon which dietary standards are based. A chapter devoted to the vitamins contains a brief account of the development of the conception of accessory food-factors and their importance in modern diets, and this is followed by a superficial account of the special significance of vitamin A, aneurin, riboflavin, nicotinic acid, ascorbic acid and vitamin D. In this chapter it is surprising to read that ascorbic acid is not an acid, and that nicotinic acid is an alkaloid like quinine and cocaine. The following three chapters, *The Choice of Food*, *Everyday Meals*, and *Diets for Mothers and Children* are the best in the book, for they contain a good deal of wise and practical advice. The final chapter comprising a brief summary of diets suitable for convalescents and for the treatment of constipation, diarrhoea, obesity and gout is not so successful, probably because it is impossible to deal with these matters without going into more detail than would be suited to such a book.

A number of useful food-tables at the end of the book are compiled mainly from the *Chemical composition of foods* by McCance & Widdowson, and *Nutritive values of wartime food*<sup>1</sup> (His Majesty's Stationery Office). The figures refer mainly to British foods. A list of further more-advanced works to which the interested reader may turn for more-detailed information is appended. From this, however, is omitted *The vitamins in medicine*<sup>2</sup> by Bicknell & Prescott.

## 1171 Milk: Production and Control

W. C. Harvey & H. Hill. Second Edition. London, H. K. Lewis & Co. Ltd., 1946. viii + 512 pages; 211 illustrations. 25 x 16 cm. £1 17s. 6d. [£1.875]

(i) Composition of food value of milk; (ii) milk and disease; (iii) the cow; (iv) clean milk production; (v) the distribution of milk; (vi) the treatment of milk by heat; (vii) laboratory methods; (viii) the future of the milk industry. Appendices. Index.

This issue is the second edition of a textbook which received a popular reception when first published in 1935. The authors, who are a Medical Officer of Health and a Sanitary Inspector, have collaborated very successfully in the production of this volume. As would be expected from such an association of authors, the aspects of hygiene and public health are kept well to the fore, and the book has supplied a much-needed want from the time of its first publication. It is evident that the authors have made a thorough study of the technical literature of their subject, and they have succeeded in presenting the textual matter in a sound and attractive manner so far as conditions in Britain are concerned.

Study of this volume should be particularly useful to advanced students of the production and handling of liquid milk, but many milk-producers, dairymen and dairy-technicians would gain a great deal by reading the book. In addition to chapters on composition and production of graded and ordinary milk, prominent features are chapters on the treatment of milk by heat, laboratory and other control, and legislation affecting milk. The book is well printed on good paper, possesses a good index, and the three appendices of 32 pages contain a wealth of practical information

for public-health officials, advisory officers in dairying, and others employed in commercial dairying.

The authors are to be congratulated upon the production of a sound and accurate presentation of an intricate subject, and statements of too sweeping a nature are few in number. The chapter on legislation does not include industrial legislation associated with dairies, such as the Factories Act, Wages Council, Weights and Measures Acts, etc., but deals more with Acts and Orders connected with Food and Drugs, Public Health, and legislation during the recent war. Presentation of legal matters in a condensed form is notoriously difficult to achieve without distortion of the real meaning, but this work has been done well. Unfortunately, obsolescence usually develops very soon with such matter, and this case is no exception, and some of the wartime orders mentioned in the text have been included in the consolidation order, Milk (Control and Maximum Prices) (Great Britain) Order, 1945, S. R. & O. No. 410. Another instance where obsolescence could have been avoided occurs on page 190, and at least three of the list of advisory dairy-bacteriologists no longer hold the positions specified; in any future edition it would be better to delete the names of the advisory officers.

This volume is one which is worthy of a good reception and should be readily available for reference purposes in every public-health department. It is hoped that fresh editions will be issued from time to time and at intervals which are sufficiently short to avoid serious obsolescence.

F. Procter

## INFECTIOUS DISEASES

## 1172 The Acute Infectious Fevers. An Introduction for Students and Practitioners

Alexander Joe. London, J. & A. Churchill Ltd., 1947. vii + 276 pages; 64 illustrations. 21 x 14 cm. 18s. [£0.9]

(i) Scarlet fever; (ii) erysipelas; (iii) puerperal sepsis; (iv) diphtheria; (v) whooping cough; (vi) cerebro-spinal fever; (vii) enteric fever; (viii) measles; (ix) chickenpox; (x) smallpox; (xi) vaccination; (xii) mumps; (xiii) rubella; (xiv) erythema infectiosum; (xv) serum reactions. Index.

This is a handy, readable little book with a good sprinkling of illustrations, likely to be popular with medical students making their first contact with the subject. The author's endeavour has been to answer the questions of the student and young resident medical officer, and he finds that, in spite of advances in the field of infectious diseases, these questions fundamentally remain constant.

This is, of course, perfectly true, but it is astonishing to what an extent the answers have been modified in the course of the last ten or fifteen years. This book is not too clear about the significance of these changes. With some notable exceptions they are all discussed, but too often without the conviction that comes from adoption or experience of them in practice. The profound effect of chemoprophylaxis and chemotherapy on acute otitis media, for example, cannot easily be realized when we are told that its incidence in scarlet fever and measles is 10%, a figure applicable to pre-sulphonamide days. In scarlatinal nephritis there is no mention of blood-urea, hypertension, salt-retention or encephalopathy. Too much space is devoted to erysipelas and its older forms which should now be defunct. Pulmonary collapse in pertussis is not even mentioned. The practice of radiography in fevers is hardly recognized. More serious is the apparent deviation of the author's practice from modern standards in the isolation-period of scarlet fever, and even of measles. Although the shorter isolation-periods are mentioned, it is not encouraging to be told that by the end of seven weeks only 70% to 80% of scarlet fever patients have returned home, and that many cases of measles are not fit to be discharged in less than three weeks.

These are examples of a certain conservatism pervading the book. Nevertheless, for its size, it contains a vast fund of information written up in an easy pleasant style. There are numerous references with name of author and date of publication scattered throughout the text, but no further details as to where they can be found. This seems to be another indication that the book is chiefly intended for the medical student.

<sup>1</sup> [For review, see *BMB* 773/154.—Ed.]

<sup>2</sup> [For review, see *BMB* 952.—Ed.]

# 1173 Infectious Diseases: with chapters on Venereal Diseases

A. B. Christie. London, Faber & Faber, Ltd., 1946. 324 pages; 4 illustrations. 22 x 14 cm. 12s. 6d. [£0.625]

General; (iii) bacteriology: (iv) diseases; (v) streptococci; (vi) staphylococci; (vii) glandular fever; (viii) chicken-pox and smallpox; (ix) fevers; (x) diarrhoeal diseases; (xi) dysentery and food poisoning; (xii) whooping cough; (xiii) pertussis; (xiv) diseases of the central nervous system; (xv) jaundice; (xvi) influenza and pneumonia; (xvii) undulant fever; typhus fever; anthrax; (xviii) common skin conditions; (xix) nursery infections; (xx) tuberculosis; (xxi) venereal diseases: gonorrhoea and allied diseases; (xxii) venereal diseases: syphilis; (xxiii) special treatment of fevers; (xxiv) what to report; (xxv) public health department. Part II: Social and Applied. (xxvi) Carriers; (xxvii) food and food-handlers; (xxviii) immunization; (xxix) cross-infection; (xxx) infection in schools; (xxxi) infection in the home; (xxxii) social aspects of infectious disease; (xxxiii) social aspects of tuberculosis; (xxxiv) social aspects of venereal disease. Index.

This book breaks new ground in the teaching of fevers to nurses. It deals not only with the clinical condition of the patient as seen in hospital, but also with the epidemiology and social aspects of the various diseases. It is clearly and concisely written. It is a book which a nurse can read quickly and enjoy.

The author gives sound advice as to the facts which must be committed to memory and those that can be deduced when once the underlying principles have been grasped. This is a praiseworthy aim, too often forgotten in the teaching of the nurse. The bacteriological data provide not only a general picture but are sufficiently detailed to act as a source of reference, which should help the nurse to co-operate intelligently with the doctor in each case as it arises. This is true also of many sections of the book. The clinical section includes not only the common fevers, but also tuberculosis and venereal diseases, the latter being treated in much more detail than is usual in nurses' textbooks. The section on the social aspects of infectious diseases, tuberculosis, and venereal disease is excellent. It gives information not hitherto available in books for the nurse training in fevers, and will certainly provide her with a wider view of the subject, which she will value particularly if she takes up home-nursing or health-visiting. It is pleasing to note that, on the subject of disinfection, the author has followed the recommendations of the Medical Research Council's War Memorandum No. 11. This may help to standardize teaching on this subject, which at present is confused. He recommends, however, two hours' rather than four hours' disinfection of excreta, a minor departure from the memorandum which hardly seems justified.

This book is highly recommended as a textbook for the fever-nurse and health-visitor. Its value will be enhanced if the author, in the next edition, can provide photographs of cases, or other illustrations.

# 1174 Human Torulosis. A clinical, pathological and microbiological study with a report of thirteen cases

Leonard B. Cox & Jean C. Tolhurst. Melbourne University Press. London, Geoffrey Cumberlege, Oxford University Press, 1946. xi + 149 pages; 67 illustrations. 25 x 19 cm. £1 5s. [£1.25]

(i) Introductory and historical; (ii) case reports; (iii) torulosis of various systems; (iv) microbiology of *Torula histolytica*; (v) experimental torulosis; (vi) pathology of torulosis; (vii) laboratory diagnosis of torulosis; (viii) sources and routes of infection in torulosis; (ix) treatment of torulosis; (x) summary and conclusions. Appendix. Bibliography. Index.

Fungi were first recognized to be a cause of disease in animals and plants early in the nineteenth century, and subsequently there was much speculation as to the part they played in human diseases. Later in the century, as a result of the classical work of Pasteur, Koch, and Lister, fungi were eclipsed by bacteria as pathogenic agents in the field of medicine and at the same time mycology suffered a divorce from medical science to the detriment of both disciplines. It is only during the last two decades that modern mycological methods have been applied to the study of "medical" fungi, and shadows of the past are discernible on the useful monograph under review.

For example, the authors rightly state that a study of torulosis "should be of interest not only to the clinician, but to the pathologist and bacteriologist". It is also of considerable interest to the mycologist. Again, applied mycologists are showing increased appreciation of the stability and international uniformity which

result from the use of specific epithets which conform to the international rules of nomenclature and it is unfortunate that the one selected by the authors for the torulosis organism is (as they suspect) never likely to prove internationally acceptable whatever the generic interpretations of the future. *Cryptococcus neoformans*, rather than *Torula histolytica* or *Cryptococcus hominis*, is the most appropriate name for the pathogen in question.

Torulosis is caused by a yeast-like organism. The skin, mucous membrane, lungs, or bone may be involved but typically there is infection of the central nervous system giving rise to a diffuse meningitis or meningo-encephalitis to which the sufferer usually succumbs. Local or widespread enlargement of the lymphatic glands, which in a significant number of cases is said to be Hodgkin's disease, frequently precedes, or is associated with, the disease and may hinder its recognition. Failure to recognize the disease is probably the reason why torulosis is considered to be so rare. It is widely distributed and there have so far been approximately one hundred published records covering the five continents. The greatest number of cases has been from North America, but the incidence is highest in Australia. Such conclusions should however be accepted with caution, as the statistics may well be representative of the interests of groups of workers rather than of the true frequency of occurrence of a disease which, like some other systemic mycoses, is liable to remain undiagnosed.

The present well-illustrated and well-documented monograph reports the histories of thirteen previously unpublished cases of torulosis encountered at the Alfred Hospital, Melbourne, since 1936, and summarizes the available clinical, pathological, and microbiological knowledge of the disease. It is a welcome addition to the literature of medical mycology and may well stimulate the monographic treatment of other mycoses.

G. C. Ainsworth

## INTERNAL MEDICINE

### 1175 Further Studies in Encephalography

E. Groome Robertson. Melbourne, Macmillan and Company Limited, 1946. x + 104 pages; illustrations. 24 x 18 cm. £2 2s. [£2.1]

(i) Ventricular filling determined by posture of the head; (ii) ventricular filling in flexion; (iii) ventricular filling with head erect; (iv) experiments in vitro; (v) factors producing the inflow of gas in vitro; (vi) an apparatus approaching more closely to the anatomical arrangement; (vii) demonstration in hydrocephalus; (viii) factors which may prevent ventricular filling; (ix) posture for filling the ventricles; (x) recent improvements in technique; (xi) the posterior fossa; (xii) the suprasellar region; (xiii) unusual path of entry to the ventricular system observed in hydrocephalus; (xiv) factors influencing filling of the lateral ventricles; (xv) pressure of the cerebrospinal fluid; (xvi) relationship of ventricles to the mid-line; (xvii) tumour or atrophy; (xviii) developmental abnormalities; (xix) anaesthesia for encephalography. References.

It was nearly thirty years ago that Dandy discovered the method of pneumo-encephalography. Since that time this technique received varying degrees of favour in different hospitals. All workers in the neurological field are agreed that this radiological investigation is of value, but there is a considerable discrepancy of opinion about the technique of introducing the gas, the type of gas to be used, and the type of patient suitable for the investigation.

Probably no one has used the method with such a wide application as Robertson. His new publication describes his experiences since 1941 when he published his first monograph on the subject—*Encephalography*. His material consists of 518 cases, 97 of which were shown to have intracranial space-occupying lesions, 28 of them infratentorial. There were no fatalities. The most revolutionary aspect of the work is the use of encephalography for the localization of infratentorial tumours. One cannot fail to be impressed by the author's courage in using this method. He states that he does it only with the co-operation of a neurosurgeon, and that many more cases must be examined before a final judgement can be passed. His further experiences will be awaited with great interest. Whatever the final outcome may be, Robertson has contributed much to our knowledge of the normal and abnormal appearances of the infratentorial cisternal spaces. His beautiful coloured illustrations are a work of art, and both the author and publisher are to be congratulated on the production of such excellent illustrations.

Many other aspects of encephalography are discussed, particularly the manner whereby the gas enters the ventricles and the

subarachnoid spaces. The observations are supported by experiments on the cadaver and *in vitro*. No one interested in neurology should fail to read this most stimulating and informative monograph.

James W. D. Bull

## 1176 Nutritional Disorders of the Nervous System

John D. Spillane. Edinburgh, E. & S. Livingstone Ltd., 1947.  
xv + 280 pages; 103 illustrations. 25 x 16 cm. £1

(i) The vitamin B complex; (ii) pellagra; (iii) beriberi; (iv) polyneuritis; (v) Wernicke's encephalopathy; (vi) nicotinic acid deficiency encephalopathy and allied states; (vii) subacute combined degeneration of the spinal cord; (viii) nutritional neuropathy in warm climates; (ix) nutritional neuropathy in war-time; (x) personal experience, 1942-46; (xi) personal experience (continued); (xii) the gastro-intestinal tract and nutritional neuropathy; (xiii) general conclusions. Appendix—case notes. Author index. Subject index.

During the recent war large numbers of men and women were exposed to severe dietary restriction over long periods, and the effects of malnutrition could be observed on a scale far beyond the reach of experimental medicine and rarely encountered even in times of severest famine. Of all the deficiency diseases which resulted, the disorders of the nervous system are probably at the present time the most imperfectly understood.

None of the neurological syndromes is new; reports from all parts of the world, appearing at intervals for more than a century, have indicated that defective nutrition may impair the function of the brain, spinal cord and special-sense organs, as well as the peripheral nerves. The author, in this monograph, brings together all the relevant information on this complex subject and, without ever being dogmatic, discusses the relationship of the nutritional neurological disorders to dietary deficiency, to known deficiency-diseases, to one-another and to certain other nervous diseases of obscure etiology.

The early chapters review, briefly but lucidly, the present state of knowledge with regard to vitamins in general, and vitamin-B complex factors in particular, to beriberi and pellagra, polyneuritis, Wernicke's syndrome and the encephalopathies associated with nicotinic-acid deficiency. The views expressed are, in the main, those generally accepted: the bibliography, well selected and full without being overwhelming, is worthy of particular attention, the author, in the course of his researches, having retrieved from obscurity a number of interesting and important, but little-known, papers. A chapter is devoted to subacute combined degeneration of the spinal cord; the possibility of a nutritional basis for this condition is discussed, and its clinical similarity to certain nutritional ataxias is pointed out.

The author then turns to nutritional neuropathy in warm climates, and detailed descriptions are given of sensory ataxia, spastic paraplegia, the "burning-feet" syndrome, retinobulbar neuritis, and nerve deafness, as they have been observed in malnutrition. While these conditions occur frequently as part of the pellagra symptom-complex, rarely in association with beriberi, and in a wide variety of combinations, it is evident that each is separate, sometimes existing independently. The evidence at present available points to vitamin-B-complex deficiency as contributory to the causation of all these states, but only in the case of "burning-feet" syndrome is there any indication of the individual factor (pantothenic acid) which may be incriminated.

The chapters recording the author's personal experiences are outstanding and could have been compiled only on the basis of much acute observation and careful investigation. As Adviser in Neurology, Middle East Command, he had the opportunity of studying a wide range of deficiency-diseases among refugees and prisoners of war; particularly a syndrome comprising retinobulbar neuritis, nerve-deafness and sensory ataxia. The general descriptions are supported by selected case-histories (in an appendix) and numerous illustrations.

The section dealing with nutritional neuropathies in prison-camps in the Far East suffers somewhat by comparison. It was, of necessity, based on a variety of reports, some very fragmentary, and important data were still unpublished at the time when it had to go to press. The resulting summary lacks the stamp of mature consideration which is apparent in the rest of the book.

Dr. Spillane has done great service both to nutritionists and neurologists in marshalling the facts and observations contained in this monograph. He has gone far to define the complex problems and indicate hopeful fields of investigation, not only of recognized nutritional neuropathies but of some nervous diseases in whose causation nutrition has not hitherto been generally thought to play a part.

Dean A. Smith

## 1177 Medical Disorders of the Locomotor System including the Rheumatic Diseases

Ernest Fletcher. Edinburgh, E. & S. Livingstone Ltd., 1947.  
xii + 625 pages; 262 figures. £2 5s. [£2.25]

(i) Definition and classification of rheumatic diseases; (ii) clinical examination of patient suspected of some locomotor disorder; (iii) physiology of joints; (iv) applied anatomy of locomotor system; (v) incidence and prevalence of adult rheumatism; (vi) predisposing conditions applicable in many forms of rheumatism; (vii) focal infection; (viii) laboratory findings in rheumatism; (ix) radiology in arthritis; (x) aetiology and pathology of rheumatic fever; (xi) diagnosis and treatment of rheumatic fever; (xii) chorea; (xiii) the relationship of rheumatic fever and rheumatoid arthritis; (xiv) aetiology of rheumatoid arthritis; (xv) diagnosis of rheumatoid arthritis; (xvi) treatment of rheumatoid arthritis; (xvii) variants of rheumatoid syndrome; (xviii) subcutaneous nodules; (xix) skin manifestations in rheumatism; (xx) aetiology and pathology of osteoarthritis; (xxi) diagnosis and treatment of osteoarthritis; (xxii) osteoarthritis of the spine; (xxiii) aetiology and pathology of fibrositis—diagnosis and treatment of fibrositis; (xxiv) specific arthritides; (xxv) miscellaneous lesions; (xxvi) ankylosing spondylitis; (xxvii) medical diseases of bone; (xxviii) gout; (xxix) sciatica; (xxx) brachial neuralgia; (xxxi) the shoulder joint; (xxxii) backache and the spine; (xxxiii) the foot; (xxxiv) peripheral vascular disorders; (xxxv) physical therapy. Appendix I. Solutions used for injections. II. Manipulation—epidural injection—seral plasters. III. Technique of joint and muscle injections. IV. Optimum position for ankylosis. V. Muscle nerve testing. VI. Certain normal blood values. Index.

Books on the rheumatic diseases published during the nineteen-thirties used to be small, rather thin volumes, as befitted a subject about which little was known and less was cared. This 1947 book runs to 625 pages and invites comparison with another fairly recent "big" book on the subject, Comroe's *Arthritis*, containing 752 pages in the first (1940) edition. Both are disproportionately heavy, in relation to their length, compared with the pre-war publications, since they are printed on good-quality paper suitable for the reproduction of photographs and x rays. This increase in unwieldiness is not primarily due to any great advance in our knowledge of the cause of "rheumatism", but rather to an increased knowledge of the things we do not know about it, and to a reluctance to discard those old bits of knowledge we now know are probably not so (e.g. the section on obesity). It is due also to the increased use of photographs and x rays in illustration, a practice which should add greatly to the readability of a book by diminishing the reading-matter. Both books are generously illustrated but contrast markedly in this respect: of Comroe's 200 illustrations, 191 were borrowed from other publications, whereas, of an even greater number in the book under review (262), the vast majority are original. Some slight duplication (e.g. fig. 12 and 187, 131 and 149, 162 and 230) might perhaps be eliminated in the next edition, together with the coloured pictures which show no more than plain ones would, but, on the whole, the illustrations are well chosen and excellently produced. A special tribute should be paid here to Dr. Golding, in whose chapter the x-ray photographs of digits are enlarged and trimmed to a size where it is possible to appreciate them visually instead of, as so often happens, through the eye of faith and the medium of the legend.

So much for the format. The contents, as may be seen from the chapter-headings listed above, cover a wide field. Particularly interesting are the specialist contributions, e.g. on dental infection by Calthrop, applied anatomy by Mitchell, radiology by Golding, electromyography by Weddell, etc. Dr. Copeman contributes a well-balanced account of fibrositis, and Dr. Donald Hunter an admirably brief (16 pages) but lucid and compact section on medical diseases of bone. The emphasis throughout the book is on clinical and therapeutic aspects: in contrast to Comroe's book, where original observations seldom intrude, this account is, in places, highly personal, quoting results of the author's own series and fragments of case-histories from a wide background of clinical observation. It is decidedly not a physiotherapist's handbook: many would feel that the value of active and passive exercises and movement was not sufficiently emphasized in the short chapter on physiotherapy, but full reference is made to this aspect under the treatment of the various individual diseases. A short bibliography, mainly anglo-american, is given at the end of each chapter, which could, in one or two instances, be lengthened to include all the authors mentioned in the text or at least one key-reference to each syndrome described. Six appendices on technical details of aspiration, injection, manipulation, etc., end a book which, it is thought, will prove both interesting and useful to those who deal with disorders of the locomotor system.

## MEDICAL ADMINISTRATION AND PUBLIC HEALTH

### 1178 Law Relating to Hospitals and Kindred Institutions (incorporating "Law for Nurses")

S. R. Speller. London, H. K. Lewis & Co., Ltd., 1947. xxxv + 399 pages. 22 x 14 cm. £1 2s. 6d. [£1.125]

Index to cases cited. Table of statutes. Part I. (i) Introductory; (ii) hospitals—definition, and classification; (iii) constitution of hospitals; (iv) general powers of hospital authorities; (v) charitable trustees and the Charity Commissioners; (vi) provision of pay beds. Part II. (vii) Consents to operations and analogous matters; (viii) injuries to patients and others; (ix) detention of patient against his will; (x) persons of unsound mind and mental defectives; (xi) loss of or damage to patient's property; (xii) births and deaths in hospital; (xiii) professional confidence and cognate matters; (xiv) ownership of medical records; (xv) poisons and dangerous drugs. Part III. (xvi) Professional qualifications; (xvii) law of master and servant as affecting hospital staff; (xviii) statutory regulation of conditions of employment; (xix) hospital rates, taxes and duties; (xx) raising money for hospitals; (xxi) gifts by will to hospitals; (xxii) hospital charges; (xxiii) nuisance and trespassers. Part IV. (xxiv) Contracts; (xxv) sale of goods; (xxvi) insurance; (xxvii) cheques, money orders and postal orders; (xxviii) the nurse's contractual position; (xxix) nursing homes and agencies for the supply of nurses; (xxx) the Public Health Act, 1936, and the Public Health (London) Act, 1936. Part V. (xxxi) National Health Service Act, 1946. Bibliography. Index.

Mr. Speller has had much experience in the legal pitfalls which may beset the hospital worker. In addition to being a Barrister-at-Law, he is Secretary and Director of Education of the Institute of Hospital Administrators and Editor of *The Hospital*. A book from his pen deserves very careful attention.

The administration of hospitals and allied institutions covers almost the whole field of human relationships and, in consequence, touches at one point or another every branch of the law, including even some aspects of criminal law. In addition to the broad general powers and duties of hospital-authorities, there are the complex relationships between hospitals and their staffs and between the staffs and the patients. In addition, there are the many special aspects, for example the law relating to insurance; the implications of the Factories Acts; the Pharmacy and Poisons Act; the Workmen's Compensation Acts; the Road Traffic Acts, etc.

One of the main characteristics of the present century has been the increasing tendency of the central government to intervene, by Statute, with the personal health-services. The Lunacy and Mental Treatment Acts and the Mental Deficiency Acts have most important effects on hospital-administration. So also has the great consolidating Public Health Act of 1936. Clearly the Midwives Acts of 1902-1936 and the Nurses Act of 1943 have also profound effects on hospitals. But it is the social legislation of the past few years that is the most revolutionary in its results. The comprehensive treatment of schoolchildren under the Education Act of 1944, the National Insurance Act of 1946 and above all the National Health Service Act will, when carried into full effect, completely alter the present arrangements in Britain for medical care, and establish a comprehensive medical service for the whole nation. Much of the law so carefully set out by Mr. Speller in this book will, therefore, be superseded in the near future. This applies particularly to Part I dealing with the definition, constitution, and powers of hospital-authorities. After the appointed day under the National Health Service Act, the present law will relate to only a small minority of hospitals and institutions not included in the National Health Service. It is necessary, therefore, to read Part I in conjunction with Part V, which describes the National Health Service Act in detail. The author makes it clear that this book is not intended as a book of reference for the legal profession, but even so it has been necessary for him to deal in some detail with the legal principles underlying the various branches of the law. Part II of the book deals with the general relationship between the patient and the hospital, and is admirably set out and clearly written. This comment applies equally to the chapters in Part III dealing with professional qualifications and the Law of Master and Servant. While it is invaluable to be able to refer to these general principles, it must be remembered always that no-one can forecast the reaction of the Courts to the individual case. This is particularly well illustrated by the case of *Gold v. Essex County Council* (1942.2A.E.R.237) described on pages 92 and 93 of this book.

In 1940 the author published his *Law for nurses*. This is now revised and incorporated in the present work but, even so, the author makes it clear that he was in two minds whether to publish

this book now or wait until the National Health Service had been in existence for a little while. He proposes to bring out a companion-volume later. It is a pity that the present volume could not be comprehensive, but enough has been said to show the great practical value of this work. The author has contrived to produce in compact form a clear exposition of the principles of the law relating to hospitals. Those who know anything of the complexities of English law and the revolutionary effects of the new social legislation will appreciate the difficulties with which he has had to contend.

A. Leslie Banks

### 1179 Municipal Health Services

Norman Wilson. London, George Allen & Unwin Ltd., 1946. 178 pages. 19 x 13 cm. 7s. 6d. [£0.375]

(i) Introduction. Part I. The services described. (ii) Maternity and child welfare; (iii) the health of the school child; (iv) tuberculosis and its treatment; (v) the control of communicable diseases; (vi) the care of the mentally afflicted; (vii) general hospitals; (viii) Poor Law and other services. Part II. The administrative machinery. (ix) The distribution of powers and duties; (x) local administration; (xi) the Ministries of Health and Education. Part III. A National Health Service. (xii) Medical services: other agencies; (xiii) need for an integrated service.

Here is a clear, brief but comprehensive account of the personal health-services. Within the 178 pages of this modestly-priced book, there is described in the first and main part services such as maternal and child-welfare, school-health, tuberculosis, control of communicable diseases, the care of the mentally afflicted, and the services provided by the general hospitals and the Poor Law. The second and third parts contain an excellent account of the administrative machinery involved, seen against the background of the needs and difficulty of local authorities.

Due doubtless to the delays and difficulties of publishing nowadays, it has not been possible to include an account of the import of the National Health Service Act on municipal health-services. This is most unfortunate, for if one requires an up-to-date and "near-future" description of our health-services, the omission is serious. Much of the present-day financial aspects of public health, the provision of free services, specialist services such as those for tuberculosis and venereal disease, abolition of compulsory vaccination, the school leaving-age—in all these and in many other matters, changes have already been determined by Parliament. Omission of any description of these changes inevitably lessens the value of this volume.

In these days of vast change, the task of an author is indeed difficult. The author of the volume under review has been particularly unlucky in this respect, for his able and valuable book *Public health services* was published shortly before the outbreak of war, when preoccupation with pressing duties of civil defence prevented the proper study and appreciation of a penetrating survey. The present volume contains reference to the disparities in the range and efficiency, in the quantity and quality of personal health-services offered by present local authorities to the citizen. In this aspect of the subject, the author has rendered outstanding service. Vigilance will be required to see that possible local inertia does not allow anything less than a uniformly-high standard of services throughout the country.

Personal health-services have been one of the glories of English social history of the last 100 years. The author tells with a compact lucidity the grand story of the development of these services, with mention of the great names of Chadwick, Simon, Ballantyne, Robert Philip, Florence Nightingale and the MacMillans. In this field, Britain has led the world. It must be admitted that we have been recently overtaken in some services, but we look to opportunities afforded by the operation of the National Health Service Act to regain a clear lead.

Every chapter of the present volume shows an exact knowledge of public health services in theory and in practice, as well as a sympathy with the common people in their needs, and deep insight into the problems involved in the provision of these services.

J. L. Burn

### 1180 Preventive Medicine and Public Health

Wilson G. Smillie. New York, The Macmillan Company, 1947. xvi + 607 pages; 41 illustrations. 22 x 15 cm. £1 10s. [£1.5]

Section I. Introduction. (i) Introduction; (ii) population trends and the public health; (iii) vital statistics. Section II. Environmental sanitation. (iv) Introduction: importance of sanitation of the environment; (v) water supplies and swimming pool sanitation; (vi) excreta disposal; (vii) vermin and their control; (viii) fumigation and disinfection; (ix) food inspection; (x)



sanitation of milk, and milk as a transmitter of disease; (xi) disease transmitted through food other than milk and milk products (food poisoning); (xii) the general environment in relation to health and disease; (xiii) housing and its relation to health. Section III. Communicable disease control. (xiv) General principles of communicable disease control; (xv) epidemiology; (xvi) control of communicable diseases of childhood; (xvii) control of acute respiratory infections; (xviii) control of enteric infections; (xix) control of tuberculosis and leprosy; (xx) venereal diseases: their prevention and control; (xxi) control of the rickettsial diseases; (xxii) control of a miscellaneous group of infectious diseases. Section IV. Child hygiene. (xxiii) Child health protection; (xxiv) oral hygiene; (xxv) school health services. Section V. Adult health protection and promotion. (xxvi) Geriatrics; (xxvii) mental hygiene; (xxviii) malnutrition and its prevention; (xxix) control of cancer; (xxx) preventive aspects of peptic ulcer and appendicitis; (xxxi) the role of public health and preventive medicine in heart disease and hypertension; (xxxii) preventive aspects of obesity and diabetes; (xxxiii) preventive aspects of arthritis; (xxxiv) preventive aspects of allergic conditions; (xxxv) preventive aspects of alcoholism; (xxxvi) industrial hygiene. Section VI. Public health administration. (xxxvii) Administration of local health services; (xxxviii) rural health administration; (xxxix) municipal health administration; (xl) state health administration; (xli) national health services; (xlii) voluntary health activities; (xliii) health education; (xliv) the public health nurse; (xlv) medical social work; (xlvi) adequacy of medical care; (xlvii) a nation-wide medical care program. Index.

This book has been prepared for American medical students "... who are planning to practice clinical medicine, and who are interested primarily in the diagnosis and treatment of disease", and the prospective reader, attracted by its title, would do well to bear this in mind when glancing through the list of contents. The work is chiefly concerned with preventive medicine as an essential part in the practice of clinical medicine, and with the duties and obligations in this field of the individual physician to his individual patients. We are not surprised therefore that the author, in his chapter on Child Health Protection, gives prematurity as the principal cause of neonatal deaths without making any direct reference to the causes of the cause (in the socio-economic background of the pregnant woman), while he devotes a page to the care of the premature infant and almost as much space to the etiology of erythroblastosis foetalis. The author's thesis is that the essential difference between Public Health and Preventive Medicine rests in the allocation of responsibility for carrying out the necessary activities involved. The former is a community-responsibility while the latter is the responsibility of the individual and his family. It is to the general practitioner in his role of medical adviser to that individual and his family that this work is directed. Even in these days of increasing health-consciousness, however, the general practitioner is still largely concerned with morbidity and the author is obliged to approach individual and public health from this starting-point. In spite of the limitations imposed upon him by the nature of his text, one would have liked to see the author use his undoubted flair for lucid exposition to greater advantage in emphasizing the need for a more positive approach to the problems of individual and communal health.

A pleasing feature of the book is the graphic and effective use of actual clinical material by way of illustration of the more important points throughout the text. The section on communicable disease is particularly well done though one is surprised, in passing, to see no reference to the association of congenital defect and rubella in this recently-published work.

Students in Britain will be particularly interested in the two last chapters in which the author discusses existing medical services in the USA and the pros and cons of a national comprehensive medical service (to which he is emphatically opposed). Just as the public-health aspects of malnutrition differ in the USA from those in Britain ("The difficulty is that we fail to utilize readily available foods," p. 411), so also does a national comprehensive medical service present different problems in the two countries according to the peculiar historical, social and economic forces at work, however much the general principles apply to both.

R. S.

## MICROSCOPY

### 1181 The Microscope. Its Theory and Applications

J. H. Wredden. London, J. & A. Churchill Ltd., 1947. xxiv + 296 pages; 298 illustrations. 25 x 15 cm. £1 1s. [£1.05]

(i) Historical introduction by W. E. Watson-Baker; (ii) elementary optics; (iii) the compound microscope; (iv) the eyepiece; (v) the objective; (vi) the substage condenser; (vii) illumination; (viii) the stand and mechanical parts; (ix) the use of the microscope; (x) an introduction to the polarising microscope; (xi) micrometry; (xii) photomicrography; (xiii) the preparation of specimens. Appendix: Refractive indices, conversion tables, useful constants, properties of circles and spheres, Nobert's test plate rulings and anti-logarithms, natural sines. Index.

The microscope has by now become an indispensable tool in laboratories, factories and workshops: inevitably many of those who are called upon to use it have little or no knowledge of the theory of optics, and too frequently perhaps only a perfunctory knowledge of what is essentially a precision-instrument. Mr. Wredden's book is admirably designed for those who, with but slender acquaintance with optics, are anxious to know how to use the microscope to the best advantage. Even experienced microscopists, however, will find much of interest and instruction in its pages. The appearance of such a work at the present time is particularly opportune, for microscopes, like so many other things, are scarce and much damage may easily be done to so sensitive an instrument by careless or ignorant handling.

The first part of the book is rightly allotted to the theoretical principles of optical instruments, and to the application of these principles in the mechanical construction of the microscope. Unless these are firmly grasped at the outset, there is no sure foundation on which more extensive knowledge can be built. A brief historical introduction is contributed by W. E. Watson-Baker, who deals with the main developments in optical instruments from the time of Roger Bacon onwards, particular attention being paid to features of the microscope so often neglected—such as stand, mechanical stage, substage and accessory apparatus.

The question of the optical system of the microscope is then taken up, refraction, the lens, chromatic aberration and image-formation being described with the help of simple diagrams. Having examined the principles of the simple microscope and the way in which magnification is produced, the arrangement of the compound microscope is discussed. Each of the various components is fully described, the section on resolution being particularly instructive. If the instructions on the use and care of objectives were more fully known, there would be far fewer complaints of the deterioration of lenses. A note might well be added in a future edition on how to prevent fungus-growth on lenses in warm climates, a discovery which in the late war saved many thousands of pounds worth of precious optical apparatus.

In connexion with substage condensers, the whole question of paraboloid condensers is very fully discussed, again with diagrams, while the section on dark-ground illumination is highly commendable. Critical illumination is a subject which is far too often neglected despite the fact that its principles were clearly demonstrated by that great English microscopist, E. M. Nelson, who died in 1938.

There are few books which give more useful tips both on the care of the instrument and, what is too often completely overlooked, the care of the microscopist's eyes—an essential but neglected link in the formation of a true visual image.

The polarizing microscope is adequately dealt with together with micrometry and projection-apparatus. A section on photomicrography includes details of the author's own apparatus for producing a critical image on the viewing-screen of the camera.

The book closes with a short sketch of methods for preparing sections and, in appendices, with a series of important tables dealing with refractive indices, conversion-factors from microns to fractions of an inch, and kindred subjects. The majority of the chapters provide references for further reading: many of these references are unsatisfactory, since they fail in the case of books to indicate the year of publication or the edition referred to, while in the case of periodicals the year, volume and page are omitted. In a second edition, reference might well be made to the use of ultra-violet radiation as an illuminant, to phase-microscopy, and even to the electron-microscope.

G. M. Findlay

## PSYCHOLOGICAL PROBLEMS OF AERIAL WARFARE

### 1182 Psychological Disorders in Flying Personnel of the Royal Air Force Investigated during the War 1939-1945 (Air Ministry Publication 3139)

By various Authors. London, His Majesty's Stationery Office, 1947. iii + 344 pages; 5 figures. 24 x 14 cm. 7s. 6d. [£0.375]

(i) Critical review of the published literature; (ii) use and abuse of the term "flying stress"; (iii) series of cases with psychological disorder examined in relation to the problem of selection of flying personnel; (iv) personal investigation of psychological disorder in flying personnel of Bomber Command; (v) personal



investigation of psychological disorder in flying personnel of Fighter Command; (vi) personal investigation of psychological disorder in flying personnel of Coastal Command; (vii) investigation of psychological disorder in flying personnel by the unit medical officers; (viii) human response to flying stress (based on the Dunham and the Croonian Lectures for 1943); (ix) statistical survey of the occurrence of psychological disorder in flying personnel in six months (3rd February to 3rd August, 1942); (x) clinical and statistical study of neurosis precipitated by flying duties; (xi) occurrence of neurosis in Royal Air Force (air crews), 1943-1944; (xii) occurrence of neurosis in Royal Air Force (air crews), 1944-1945; (xiii) time of recognition of neurosis in flying personnel; (xiv) predisposition to psychological disorder in normal flying personnel; (xv) signs of temperamental unsuitability in air crews under training. Appendix to chapter xv. Notes for flying instructors on recognition of nervousness in pilots under training; (xvi) assessment of temperament in connection with selection of air crews; the psychiatric method employed. Appendix to chapter xvi: Note on the observers' analysis of their method; (xvii) probability of return to full flying of men who have broken down under the strain of operational duties; (xviii) prognosis for a return to full flying duties after psychological disorder; (xix) some measures of the effect of operational stress on bomber crews; (xx) episodes of unconsciousness, confusion and amnesia while flying; (xxi) psychological aspects of airsickness; (xxii) reliability of psychiatric opinion in the Royal Air Force; (xxiii) fluctuations in navigator performance during operational sorties. Glossary. Index.

These studies were carried out in circumstances which made leisurely experiments and well-controlled observations practically impossible, yet they show a consistently high level of thoroughness and sound judgement in seizing on essential problems and making the most of the available data. The bulk of the papers was submitted between 1942 and 1944 to the Flying Personnel Research Committee, and all but four of them were the work of Air Vice-Marshal Sir Charles Symonds and Wing-Commander Denis Williams.

The strain to which RAF aircrews were exposed made it imperative that psychological disorders should be promptly detected and, to the fullest extent possible, prevented. Consequently the nature and causes of these psychological disorders needed close investigation. The first six chapters of this book, written during 1942, show how methodically this was done. The published literature is critically reviewed, the concept of "flying stress" as an illness in itself is examined (and rejected), and a preliminary study is made of 100 members of aircrew referred on account of neurotic symptoms, with a particular eye to evidence of predisposition which might have been detected at the time when they were selected for air duties. Then the experience of executive and medical officers is tapped to discover the causes and signs of psychological upset in aircrews of Bomber, Fighter and Coastal Commands. The Croonian Lectures in 1943 provided the occasion for a review of some general and theoretical implications of the evidence of fear, courage, and emotional tension exhibited by flying personnel; in these lectures the concept of inhibition is borrowed from neurophysiology, and elaborated along Pavlovian lines, though unfortunately the circumstances in which the lectures were delivered prevent detailed consideration of the difficulties inherent in such interpretation.

A series of papers analyzing the incidence of various forms of psychological disorder in the aircrews led to a more and more emphatic statement of the importance of predisposition: thus it was found that two-thirds of the flying personnel referred to neuro-psychiatrists during a period of six months had been subjected to only slight flying-stress or none at all; there was an inverse relationship between the signs of previous severe predisposition and the degree of flying-stress in these men. Such considerations as these showed the basic identity of the problems arising among airmen and the kindred problems familiar in civil life, the differences being only "in the kind and degree of psychological stresses encountered, which in turn depend upon the specialised and hazardous nature of the patients' duty."

The study of predisposition in aircrew who have broken down casts the problem back to the means of detecting predisposed men at the stage of selection and preliminary training. Chapters 15 and 16 deal with the psychiatrists' data on this, collected in an investigation of 1009 pilots under training and 335 night-bomber pilot-instructors who had completed their tour of operational duty: an interview was the basis for determining the presence of any of ten specified traits considered to be indicative of predisposition, and for rating the degree of predisposition in the individual pilot. The conclusions indicate, *inter alia*, that such traits as anxiety, obsessional features and a family history of mental illness could be found in pilots who completed their operational tour without needing psychiatric attention, whereas timidity, lack of persistence, affective lability and psychological immaturity were associated with severe predisposition to breakdown. An investigation such as this relies heavily on the acumen of the psychiatrist: hence the need for the interesting chapter, by Professor Bradford Hill and Wing-Commander Williams, which examines the reliability of psychiatric opinion, as judged by the agreement found

between reports on the same man by different psychiatrists. An incidental observation arising from the latter inquiry was that in many cases there can, from the medical aspect, be no certain dividing line (such as is commonly assumed) between normal and abnormal fear, i.e. anxiety. Prognostic and statistical papers, by Squadron-Leader D. D. Reid, report various measures of the effect of stress, and, with clinical studies on airsickness and episodes of unconsciousness, make up the rest of this very informative work.

A. J. L.

## SUPPORT FOR THE IMPOTENT

### 1183 The Treatment of Impotence. With special reference to Mechanotherapy

Joseph Loewenstein. London, Hamish Hamilton Medical Books, 1947. 49 pages; 4 figures. 19 x 12 cm. 6s. [£0.3]

(i) Introduction; (ii) definitions; (iii) physiological mechanism of erection; (iv) psychological impotence and psychological treatment; (v) history and literature of mechanotherapy; (vi) the technique of the C.T.A. treatment; (vii) the course of the C.T.A. treatment; (viii) indications; (ix) statistics; (x) failures of mechanotherapy; (xi) mechanotherapy and fertility; (xii) case records. References. Index.

Functional impotence may respond rapidly to treatment or it may prove refractory to even a long course of psychotherapy. Any ancillary method of treatment which will allow of the patient's achieving an even moderately successful sexual intercourse is therefore invaluable, since it will restore what has so far been lacking, namely, confidence in his sexual capacity. The author of this book has called attention to a method of treatment which has fallen into disuse in Britain. Krafft-Ebing was of the opinion that mechanical expedients will always be in demand in the treatment of impotence, but in England the use of penile splints is almost unknown. This is probably due to the fact that an easily adjustable mechanical support for the penis has hitherto not been available. Dr. Loewenstein has supplied what we have lacked and his "coitus training apparatus" should be of great use both to psychologists and genitourinary surgeons. The technique of the use of this apparatus is of considerable importance and he gives a full account both of the method of applying it and of the measurements required in order to obtain a model of the right size. During the last four years he has treated 40 cases with his form of penile splint and has obtained 26 cures, the average duration of treatment being four months. As Dr. E. B. Strauss points out in his foreword: "Unsuccessfully treated impotence can be one of the most distressing conditions from which a man may suffer, with far-reaching effects not only on his own life but on the life of his dependents. . . . Any method of treatment which reduces the percentage of failures is therefore to be welcomed, and Dr. Loewenstein must be thanked for bringing again to our notice a remedy which has been forgotten. He writes simply and clearly and his text is supplemented by helpful illustrations.

Kenneth Walker

## SURGERY AND OBSTETRICS

### 1184 Textbook of Surgical Treatment Including Operative Surgery

Edited by C. F. W. Illingworth. Third Edition. Edinburgh, E. & S. Livingstone Ltd., 1947. xii + 644 pages; 289 illustrations. 25 x 16 cm. £1 12s. 6d. [£1.625]

(i) Pre-operative and post-operative care; (ii) wounds and wound infections; (iii) penicillin in surgery; (iv) the treatment of burns; (v) amputations; (vi) affections of blood vessels; (vii) affections of the skull and brain; (viii) affections of the spine and spinal cord; (ix) peripheral nerve injuries; (x) surgery of the autonomic nervous system; (xi) diseases of bones; (xii) diseases of joints; (xiii) tuberculosis of bones and joints; (xiv) paralysis and contracture; (xv) fractures; (xvi) affections of the shoulder region and arm; (xvii) affections of the elbow; (xviii) affections of the hand; (xix) affections of the hip; (xx) affections of the knee; (xxi) affections of the foot; (xxii) radiotherapy; (xxiii) plastic surgery; (xxiv) affections of the face, mouth, jaws, and salivary glands; (xxv) affections of the neck; (xxvi) affections of the thyroid gland; (xxvii) affections of the larynx, pharynx, and oesophagus; (xxviii) affections of the breast; (xxix) affections of the thorax; (xxx) hernia; (xxxi) affections of the stomach and duodenum; (xxxii) affections of the intestines; (xxxiii) affections of the rectum and anus; (xxxiv) affections of biliary tract, pancreas, and spleen; (xxxv) affections of the appendix; (xxxvi) affections of the kidney and ureter; (xxxvii) affections of the bladder and urethra; (xxxviii) affections of the male genital tract; (xxxix) rehabilitation. Index.

Good looks are always attractive, and this book certainly has the attraction of a good outward appearance. The saying that beauty is only skin-deep does not apply here, for the contents are also good, sound and well-presented. The fact that this is the 3rd

edition within four years suffices to show that the purpose for which the book was written—to present a general outline of surgical treatment for senior students—has been fulfilled.

The additions in this edition are supremely important, for that truly miraculous drug—penicillin—has been accorded its proper place in the treatment of carbuncle, osteomyelitis and the many other diseases for which it has proved so efficacious. There is also an excellent chapter describing the scope of its action and the dosage and technique needed for its administration.

The scope of surgery varies from year to year; in this book the addition of a chapter on rehabilitation is an illustration of this, and the entire absence of any reference to syphilis or gonorrhoea is perhaps another indication of the same fact. We think, however, that it might be worth while adding a short paragraph on glanders, anthrax and actinomycosis. Moreover, acute dilatation of the stomach ought to be mentioned, for this serious condition is often overlooked and needs further publicity than is usually accorded to it. The various contributors have shown a catholicity in their views and a moderation in expressing them so that we have little to criticize; we were however surprised to see on page 530 that with a volvulus of the sigmoid colon "... on no account must the distended colon be brought outside the abdomen", for we have continued to do this without ill effect for thirty years and cannot agree that it is wise to write: "... without the support of the abdominal wall it may rupture." If this accident has ever happened, such an exceptional occurrence surely ought not to be made the basis of a rule. Finally, we find it a little difficult to understand why the disorders of the mouth, pharynx and larynx are dealt with but no mention is made of that most important structure—the tonsil. However, this is a good book and we can recommend it to students.

V. Zachary Cope

## 1185 Introduction to Surgery

Virginia Kneeland Frantz & Harold Dortic Harvey. New York, Oxford University Press; London, Geoffrey Cumberlege, 1946. xii + 216 pages; 11 illustrations. 19 x 12 cm. £1 5s. [£1.25]

Introduction. (i) History; (ii) injury and inflammation; (iii) repair; (iv) degeneration, hypertrophy, atrophy, regeneration; (v) deformities; (vi) cysts; (vii) neoplasms; (viii) contusions; (ix) abrasions; (x) incised wounds; (xi) wounds with loss of substance; (xii) repair of accessory skin structures; (xiii) repair of mucous membrane; (xiv) repair of muscle; (xv) repair of tendon; (xvi) repair of hollow and solid viscera; (xvii) repair of nervous system; (xviii) repair of serous synovial surfaces; (xix) repair of cartilage; (xx) repair of bone; (xxi) foreign bodies; (xxii) calculi; (xxiii) infection; (xxiv) specific infections; (xxv) infection in serous and synovial cavities; (xxvi) infection in bone; (xxvii) drainage; (xxviii) operative wounds; (xxix) accidental wounds; (xxx) ulcers; (xxxi) burns; (xxxii) gangrene; (xxxiii) haemorrhage; (xxxiv) shock; (xxxv) contact with the patient; (xxxvi) surgical technique; (xxxvii) anaesthesia; (xxxviii) plastic surgery; (xxxix) experimental surgery; (xl) envoi. Bibliography. Index.

This attractive little book is based upon an introductory course in second-year surgery at Columbia University—a course which Allen Whipple speaks of as "the most valuable and instructive course in the Surgical Curriculum". It deals with the principles which underlie all surgical work, and certainly forms an excellent basis on which the student may build his own experiential superstructure. After a brief historical review, the authors deal with the pathology and clinical features of injury, repair, infection and inflammation as they affect different tissues and organs. Then ulcers, burns, gangrene, haemorrhage and shock are considered, and finally there is an excellent section on contact with and examination of the patient. In 208 pages there is compressed an immense amount of information, and after reading it through we consider it the most generally useful introduction to surgery we have yet seen. It is not entirely free from minor inaccuracies and omissions. A boil is not a simple abscess round a hair-follicle, but a small focus of infective gangrene; echinococcal cysts are not due to infection, for worms are not usually classed among the germs. We are told the way to prevent tetanus but not how to safeguard the patient against gas-gangrene. We think the authors go too far in saying that the "so-called pressure points along the arteries which have been recommended in First Aid Manuals, are not useful to the surgeon." Finally, though we are in favour of stimulating the student's own observation, we think it is rather discouraging to the student to be told: "No authority in surgery can be accepted without question". Taken at its face-value, that statement would make both teaching and learning extremely arduous or impossible. Nevertheless, we strongly recommend this book to the student and hope that it may be possible to reduce the price in the future.

V. Zachary Cope

## 1186 The Student's Handbook of Surgical Operations

Sir Frederick Treves. Eighth Edition, revised by Cecil P. G. Wakeley. London, Cassell & Company, Ltd., 1946. xi + 574 pages; 281 illustrations. 15s. [£0.75]

(i) Ligature of arteries; (ii) operations on nerves; (iii) amputations; (iv) operations for the division of the scrotum and head and spine; (v) operations on the chest; (vi) treatment of varicose veins; (vii) radium and its use in the treatment of cancer; (viii) skin grafting. Index.

Here is an old friend rejuvenated. Rejuvenation is a more difficult operation than most of those described in the book, but in this case it has been done well, though not perfectly. In fact, it is doubtful whether any senior surgeon can ever entirely put himself in the position of a student. There is something to be said for the revision of old books by young men of registrar status, for they alone know exactly what the students need.

In this edition, the reviser has eliminated much obsolete material and added some operations of recent growth. Gone are Lisfranc's, Tale's and Chopart's amputations, disregarded are Pirogoff's, Stokes-Gritti's, and Carden's, but we are rather glad to see that Syme's amputation still has a place in a student's manual. Ligature of the patent ductus arteriosus and lobectomy are described, and additions have been made to the section on neurosurgery. But we look in vain for any reference to the spleen, nor is there any description of laryngectomy or tonsillectomy, although we are told how to do a laryngotomy and how to open a peritonsillar abscess. It is strange that in the discussion of anaesthesia for thoracic empyema no mention is made of local anaesthesia, for that is in many cases the method to be chosen. In the section on nephrectomy we find no description of the technique so commonly employed in which clamps are placed on the renal pedicle. These few criticisms will show that there are many points which will need attention in future editions, but nevertheless the book will still prove useful to the student and provide an introduction to what has now become a very comprehensive subject.

## 1187 Textbook of Obstetrics

Gilbert I. Strachan. London, H. K. Lewis & Co. Ltd., 1947. xi + 731 pages; 326 illustrations. 24 x 16 cm. £2 5s. [£2.25]

(i) The anatomy and physiology of reproduction; (ii) normal reproduction; (iii) the newborn child; (iv) the pathology of pregnancy; (v) complicated labour; (vi) the morbid puerperium; (vii) obstetrical operations; (viii) the casualties of childbirth; (ix) blood transfusion in obstetric practice. Index.

This book, which covers the whole of obstetrics, embodies, as the author says "... the experience of many years of teaching and practice in this speciality" and "... the personal aspect of the matter has been stressed ...". Therein lies the charm of this new and valuable contribution to obstetrics; it is clearly the work of one who knows his subject, and the profusion of good illustrations makes it a book from which the undergraduate can learn all that he requires.

There is much in the book which deserves praise, the emphasis on conservatism in the policy of "hands off" deserves mention, especially now that caesarean section is becoming so popular and often so unnecessary a solution for many obstetrical difficulties.

The author's conservative outlook has, however, led to the advocacy of certain statements and policies with which many will disagree. Thus his average pelvic measurements are presented in an old-fashioned way without any measure of the range, and with a figure for the true conjugate which is much too low. His advice of 10–14 days in bed after childbirth will be criticized by many, and he still recommends a low-protein diet in pre-eclampsia. There does not appear to be any mention of the value of a salt-poor diet in such cases. The section on inertia is especially good, and it was delightful to read his criticism of the over-emphasis on pelvic shape usually associated with the names Colwell and Moloy. His outright condemnation of forceps-delivery in inertia in the second stage is not justified now that it is known that it is the paralyzing effect of the anaesthetic on the uterus rather than the inertia which is the danger. Though there is a section on blood-transfusion there is no mention of the

importance of the "Flying Squad" to bring blood to the patient's home, and it is clear that the author considers that blood is often given unnecessarily.

In spite of any shortcoming that has been mentioned this is a carefully-compiled book that should be popular. No one could study it without being the wiser for it.

C. Scott Russell

## 1188 Postgraduate Obstetrics

William F. Mengert. London, Hamish Hamilton Medical Books, 1947. xv + 392 pages; 123 illustrations. 23 x 14 cm. £1 5s. [£1.25]

Section I: Pregnancy. (i) The diagnosis of pregnancy; (ii) prenatal care; (iii) minor ailments of pregnancy; (iv) disease complications related to pregnancy; (v) intercurrent diseases unrelated to pregnancy; (vi) abortion and premature labor; (vii) abnormal pregnancy; (viii) antepartum hemorrhage—placenta previa and premature separation; (ix) sex hormones in pregnancy; (x) estimation of the bony pelvis. Section II: Labor. (xi) The conduct of labor; (xii) obstetric analgesia and anesthesia; (xiii) postpartum hemorrhage; (xiv) repair of tears; (xv) obstetric forceps; (xvi) cesarean section; (xvii) miscellaneous delivery operations; (xviii) anomalies of the expulsive forces; (xix) miscellaneous complications of labor. Section III: The puerperium. (xx) Management of the normal puerperium; (xxi) care of the newborn; (xxii) anomalies, injuries, and diseases of the newborn; (xxiii) puerperal infection; (xxiv) miscellaneous diseases and complications of the puerperium; (xxv) the follow-up examination; (xxvi) sterility; (xxvii) the emotional stresses of pregnancy; (xxviii) laboratory and technical procedures. Appendix. Nursing techniques. Index.

The scope of this book is any disease or complication in the pregnant, parturient or puerperal woman, and in the newly-born child, such as might occur in the practice of a physician seeing maternity cases at the rate of fifty a year. Apart from a short chapter on sterility there is no gynaecology. As its title suggests, this book is essentially a book for the practising physician; it is pleasantly short, well written, covers a wide field, is sensibly illustrated and is up-to-date.

The author's attitude to many of the practical problems in obstetrics is so kindly, logical, and wise that the book might almost be described as excellent if it were not for a rather unjustified and recurring undercurrent of fear—the fear of caesarean section in the presence of sepsis. Thus, he doubts whether the operation should be performed after twelve hours of labour for fear of infection and insists that "... caesarean section in the presence of actual, and often with potential, infection is best followed by hysterectomy", and that "caesarean section has little place in the treatment of prolonged labor due to uterine inertia. By the time prolongation of labor is recognized, twenty-four or more hours have elapsed. *Cesarean section late in labor imposes a prohibitive maternal mortality risk* unless the physician is prepared to perform extraperitoneal section or caesarean hysterectomy." Such an attitude must of necessity in some cases lead to the unnecessary performance of the operation early in labour, and before the uterus has been given a real chance of expelling its contents. Furthermore, it is not true; with penicillin and sulphonamide-therapy the risk of caesarean section to the mother even in the presence of infection is not nowadays sufficient to withhold this line of treatment if the other circumstances of the case demand it.

This criticism should not lessen the general excellence of a book which I can thoroughly recommend to the practitioner who wishes to bring his knowledge of obstetrics up to date.

C. Scott Russell

## 1189 A Short Textbook of Midwifery

G. F. Gibberd. Fourth Edition. London, J. & A. Churchill Ltd., 1947. viii + 563 pages; 195 illustrations. 21 x 14 cm. £1 1s. [£1.05]

(i) The anatomy of the pelvis and its contents; (ii) the development of the ovum; (iii) the anatomy and physiology of pregnancy; (iv) the diagnosis of pregnancy; (v) the management of normal pregnancy; (vi) the anatomy and physiology of normal labour; (vii) clinical course and management of normal labour; (viii) occipito-posterior positions of the vertex; (ix) multiple pregnancy; (x) ectopic pregnancy; (xi) pregnancy complicated by pelvic abnormalities; (xii) diseases of the ovum in the early months of pregnancy; (xiii) diseases of the ovum in the later months of pregnancy; (xiv) the toxæmias of pregnancy; (xv) diseases associated with pregnancy; (xvi) malpresentations; (xvii) presentation and prolapse of the cord; (xviii) contracted pelvis; (xix) abnormalities in uterine action during labour; (xx) abnormalities in the birth-canal during labour; (xxi) ante-partum haemorrhage; (xxii) abnormalities in the third stage of labour; (xxiii) the normal puerperium; (xxiv) puerperal infections; (xxv) the abnormal puerperium; (xxvi) obstetric operations; (xxvii) the normal infant; (xxviii) the premature infant; (xxix) the abnormal infant. Index.

This short textbook, now in a fourth edition, is firmly established as a good friend of the student and its popularity is well deserved; it is clearly written, reasonably short and accurate and adequately illustrated. In one or two respects, however, it might be improved.

Thus the chapter on Puerperal Infections is rather too long and complicated. The description of the Management of the Primiparous Breech Delivery is lacking in just that detail which is so necessary for the successful conduct of such cases. In some respects, the author is over-conservative; he believes that pyelitis of pregnancy should be treated with alkalis rather than with the sulphonamides, and in the section where he discusses upper-segment and lower-segment caesarean sections, he advises "that it is probably better to perform an upper segment operation if the patient is not in labour". Although this advice may be suitable for the occasional operator, it is not in keeping with the trend of modern opinion. In the section on Contracted Pelvis, too much emphasis is placed on the size of the pelvis and too little on the size of the foetal head.

Apart from such relatively minor faults, the book is up-to-date, the text has been thoroughly revised and makes a useful contribution to the teaching of obstetrics.

C. Scott Russell

## TROPICAL MEDICINE

### 1190 The Principles and Practice of Tropical Medicine

L. Everard Napier. New York, The Macmillan Company, 1946. xvi + 917 pages; 24 plates; 195 figures. 25 x 16 cm. £1 15s. [£1.75]

(i) General considerations; (ii) measures for mitigating the effects of tropical climate; (iii) diseases due to the direct effects of tropical climate; (iv) malaria; (v) leishmaniasis; (vi) trypanosomiasis; (vii) the relapsing fevers; (viii) rat-bite fever; (ix) leptospirosis; (x) the typhus fevers; (xi) oryza fever, or bartonellosis; (xii) yellow fever; (xiii) Rift valley fever; (xiv) dengue sand-fly group; (xv) plague; (xvi) tularemia; (xvii) the undulant fevers; (xviii) melioidosis; (xix) the intestinal fluxes; (xx) leprosy; (xxi) yaws and associated diseases; (xxii) tropical skin ulcerations; (xxiii) lymphopathia venereum; (xxiv) granuloma venereum; (xxv) some common skin diseases of the tropics; (xxvi) helminthic infections; (xxvii) cosmopolitan intestinal nematode infections; (xxviii) tropical intestinal nematode infections; (xxix) tapeworm infections; (xxx) trichinosis; (xxxi) filariasis; (xxxii) dracunculiasis, or guinea-worm disease; (xxxiii) gnathostomiasis; (xxxiv) schistosomiasis; (xxxv) other fluke infections; (xxxvi) hydatid disease; (xxxvii) nutrition and nutritional disorders in the tropics; (xxxviii) anaemia in the tropics; (xxxix) snakes and snake-bite; (xl) rabies; (xli) a note on myiasis and scabiasis. Subject index. Author index.

This is a sound and readable book written in a vigorous clear style. The emphasis is laid mainly on tropical disease as seen in India, and in most chapters the author's wide personal experience gives peculiar vitality to his writing. The book has been written mainly for clinicians, but covers the parasitological, pathological and preventive aspects of the subjects discussed. There are certain unusual and strong-minded omissions. Smallpox and typhoid fever, for example, both of acknowledged importance in tropical countries, are not described, on the grounds that they are adequately dealt with in ordinary textbooks of medicine. Tuberculosis, eye-diseases and general mycotic infection are also excluded. On the other hand, space is given to an account of tularemia. The author defends his "errors" of "omission and commission" in his preface.

The general arrangement of the book has gained considerably by slight reduction to a minimum of those descriptions of arthropod vectors and laboratory procedures which so often make such volumes unwieldy. Each chapter is headed by an outline of its contents, an innovation likely to appeal to student-readers. The line-illustrations are clear, but some of the half-tone plates are indistinct and could be omitted without serious loss to the text.

The introductory chapters cover general considerations of life in the tropics, including a short account of the effects of heat. Some 70 pages are devoted to malaria, and make good reading. The clinical account is particularly clear, but certain points in the treatment of malaria are not altogether in keeping with contemporary views. The author refers several times to suppressive dosage with antimalarial drugs as "prophylactic" dosage, although he points out elsewhere that the process is one of suppression and not prophylaxis. He recommends the use of mepacrine [atebrin] as a "prophylactic" for an individual touring an endemic area, and quinine, rather than mepacrine, for a resident in such an area, "... in view of our lack of knowledge of the effects of atebtrin over a very long period ...". He also suggests the use of 100 mg. mepacrine three times daily for 5 days in the treatment of benign tertian malaria and for 7 days ("but not longer") in the treatment of malignant tertian. Later in the chapter he details the higher

dosage of mepacrine used during the war by the US Army, and recommends "For causal prophylaxis (suppressive treatment), the daily administration of 0.1 gramme of atebirin for six days a week . . .".

Professor Napier has added this and similar summaries of recent information to the text of the first half of the book in an attempt to bring up to date the earlier chapters, which, as he explains in a footnote in the preface, were published separately in India in 1943. This is understandable in view of the enormous volume of work done during the war and only now being released for publication, but such addenda sometimes lead to confusion, especially when the information they contain is at variance with that in the main text. The brief chapter on blackwater fever suffers in this way from a short addendum which modifies the text and serves to confuse the reader. For instance, the author recommends in the text the free use of alkali in the treatment of blackwater fever since "... at all costs the urine must be kept alkaline to prevent precipitation of the haematin and the consequent damage to the renal tubules." In the addendum to the chapter, however, he presents the more modern view that "... treatment by excessive alkalization may do more harm than good." To the physician faced with a case of blackwater fever in which the kidneys are damaged and the urine remains persistently acid in spite of alkali treatment, these two statements are incompatible. The reviewer feels that on points such as this, the author should state his views clearly and definitely, as a guide to the reader; summaries of recent work are insufficient. No doubt this minor defect in this otherwise excellent book will be rectified in subsequent editions.

The chapters on kala-azar, leishmaniasis and cholera are first-rate. The author's wide personal experience dominates the picture and the result is a clear and precise account of both clinical and scientific aspects of the disease discussed. Helminthic infections are dealt with in an excellent series of chapters, and there are good chapters on trypanosomiasis, the relapsing fevers, rat-bite fever, Rift Valley fever, dengue, plague, undulant fever, melioidosis, the intestinal fluxes, leprosy (written by Dr. John Lowe), yaws, tropical skin-ulcerations, lymphopathia venereum, skin-diseases and nutritional disorders in the tropics. Pinta and bejel are discussed with yaws. Rabies is described very briefly, and there is an interesting section on snakes and snake-bite. In the immediate treatment of the latter, multiple incision through the fang-marks is recommended without any mention of preliminary washing of the wound to remove dribbled venom. In the list of common african poisonous snakes *Bitis gabonica* should have been included

B. G. Maegraith

#### PARTICULARS OF BOOKS REVIEWED ELSEWHERE IN THIS NUMBER

The numerals in square brackets  
are the serial numbers of the  
articles in which these books are  
reviewed

#### [1121] Intelligence and Fertility. The effect of the differential birthrate on inborn mental characteristics

Sir Cyril Burt. London, The Eugenics Society and Hamish  
Hamilton Medical Books, 1946. 43 pages. 21 x 14 cm.  
2s. [£0.1]

(i) Early investigations on selected groups; (ii) later investigations on unselected groups; (iii) relation between intelligence and size of family; (iv) geographical distribution of intelligence and family size; (v) estimating the amount of apparent decline; (vi) rate of decline in the country as a whole; (vii) alleged increase of mental deficiency; (viii) final conclusion. Appendix: On the meaning of intelligence.

#### [1123] Researches on Pre-Natal Life. Volume I

Sir Joseph Barcroft. Oxford, Blackwell Scientific Publications,  
1946. xiii + 292 pages; 124 figures. 25 x 19 cm. £1 17s. 6d.  
[£1.875]

(i) The disposition of vessels in the placenta; (ii) crossing the placental barrier; (iii) the growth of the body and of its constituent parts; (iv) comparison of length and weight in twins; (v) the relative claims of the foetus and mother to available nutritive material; (vi) the blood volume in the foetal circulation and its distribution between the foetus and the placenta; (vii) transfer of blood from the placenta to the foetus at birth; (viii) water content of foetal tissues; (ix) basal oxygen consumption of tissues considered in terms of slices; (x) the output of the heart; consumption of tissues considered in terms of slices; (xi) the development of vascular reflexes; (xii) the development of vascular reflexes; (xiii) the oxygen

capacity of the blood; (xiv) the oxygen dissociation curve; (xv) acid-base equilibrium and CO<sub>2</sub> dissociation curves; (xvi) the oxygen in the umbilical vessels; (xvii) the carotid blood; (xviii) the circulation through the foetal chest—the venous side; (xix) the circulation through the arteries in the foetal chest; (xx) closure of the ductus arteriosus and foramen ovale; (xxi) the respiratory process; (xxii) the onset of respiratory movement. Appendices. Indices.

#### [1124] The Embryology of Behavior. The Begin- nings of the Human Mind

Arnold Gesell in collaboration with Catherine S. Amatruda.  
London, Hamish Hamilton Ltd. [1947]. xix + 289 pages;  
391 illustrations. 24 x 16 cm. £1 1s. [£1.05]

(i) The search for beginnings; (ii) birth and age; (iii) zygote and embryo; (iv) the genesis of behavior; (v) the archaic motor system; (vi) the growth of fetal behavior; (vii) breathing behavior; (viii) muscle tonus; (ix) electrotonic integration; (x) the fetal-infant; (xi) the circumnatal infant; (xii) the diurnal cycle of sleep and wakefulness; (xiii) species and individual; (xiv) the dynamic morphology of behavior; (xv) the hierarchical continuum. A photographic delineation of behavior patterns and growth sequences. Appendix A. The investigation in outline. B. The developmental diagnosis of age. Selected references. Index.

#### [1125] História da Lepra no Brasil. Volume I. Períodos Colonial e Monárquico (1500-1889)

Heraclides-Cesar de Souza-Araujo. Rio de Janeiro, Imprensa  
Nacional, 1946. xiii + 559 pages; 40 illustrations.  
31 x 23 cm.

(i) Da descoberta do Brasil até o fim do domínio espanhol (1500-1640); (ii) a situação do problema da lepra na época dos vice-reis (1640-1808); (iii) história do Hospital dos Lazares do Rio de Janeiro de 1763 a 1808; (iv) introdução e expansão da lepra no interior do Brasil na época dos vice-reis; (v) progresso da profilaxia da lepra no reinado de D. João VI (1808-1821); (vi) actividades contra a lepra durante o reinado de D. Pedro I (1821-1831); (vii) o problema da lepra no período da regência (1831-1840); (viii) reinado de Dom Pedro II (1840-1889). Primeira parte (1840-1860); (ix) reinado de Dom Pedro II (1840 a 1889). Segunda parte (1861 a 1889). Bibliografia. Índice geral.

#### [1126] Bacteria in Relation to Domestic Science

C. E. Dukes. London, Geoffrey Cumberlege: Oxford  
University Press, 1947. viii + 240 pages; 1 plate, 9 figures.  
19 x 12 cm. 12s. 6d. [£0.625]

(i) General characteristics of bacteria; (ii) bacteriology of the air; (iii) bacteriology of the soil; (iv) bacteriology of water; (v) bacteriology of milk; (vi) bacteriology of milk products; (vii) bacteriology of meat, fish and eggs; (viii) bacteriology of fruit and vegetables; (ix) bacteriology of alcoholic beverages, ginger beer and vinegar; (x) bacterial decomposition and decay; (xi) preservation of food by heat; (xii) preservation of food by cold; (xiii) preservation of food by drying, salt and sugar; (xiv) preservation of food by chemicals and by lactic fermentation; (xv) bacterial food poisoning in general; (xvi) food poisoning due to *Salmonella* bacteria; (xvii) food poisoning due to dysentery and cholera; (xviii) enteric fever; (xix) staphylococcal and streptococcal food poisoning; (xx) botulism. Glossary. Index.

#### [1126] The Bacteriology of Spray-dried Egg with Particular Reference to Food Poisoning

By various Authors. London, His Majesty's Stationery Office,  
1947. 66 pages. 22 x 15 cm. 1s. [£0.05] (Medical  
Research Council Special Report Series No. 260)

(i) The bacteriology of dried egg; (ii) salmonella infections of human beings associated with the consumption of dried egg; (iii) outbreaks of food poisoning of the toxin type following the consumption of dried egg; (iv) salmonella infection of pigs probably due to dried egg. General summary and conclusions. References. Appendix.

#### [1127] Molecules Against Microbes

E. S. Duthie. London, Sigma Books Ltd., 1946. 156 pages;  
illustrated. 19 x 13 cm. 6s. [£0.3]

(i) Microbes and disease; (ii) chemical structure of drugs; (iii) discovery of salvarsan; (iv) chemistry conquers tropical disease; (v) chemistry conquers tropical disease (continued); (vi) chemistry conquers bacteria; (vii) discovery and development of penicillin; (viii) the conquest of wound sepsis; (ix) chemotherapy in everyday medicine; (x) recent developments and future prospects. Some landmarks in chemotherapy. Reference tables. Glossary. Index.

#### [1127] The Road to Penicillin: A History of Chemotherapy

Margaret Goldsmith. London, Lindsay Drummond Ltd.,  
1946. 174 pages; 26 illustrations. 22 x 14 cm. 10s. 6d.  
[£0.525]

(i) Introduction; (ii) early groping; (iii) early middle ages; (iv) Fracastorius and Paracelsus; (v) Leeuwenhoek's "little animals"; (vi) chemical attacks against disease; (vii) Edward Jenner; (viii) the beginning of modern progress; (ix) Perkin's aniline-purple; (x) Joseph Lister; (xi) Louis Pasteur; (xii) Robert Koch; (xiii) Paul Ehrlich; (xiv) the new chemotherapy; (xv) Sir Alexander Fleming; (xvi) Sir Howard Florey. Bibliography. Index.



**[1127] Miracle Drug. The Inner History of Penicillin**

David Masters. London, Eyre & Spottiswoode, 1946. 191 pages; 23 illustrations. 15 x 22 cm. 10s. 6d. [£0.525]

(i) The battle of germs; (ii) Fleming finds the mould; (iii) the mould keeps its secret; (iv) the third attempt; (v) the fourth attempt; (vi) a vital decision; (vii) a pinch of brown powder; (viii) the miracle; (ix) the chemists triumph; (x) Florey seeks American aid; (xi) the struggle for production; (xii) back from the grave; (xiii) saving the wounded; (xiv) the crystals are found; (xv) the final phase. Appendix. Index.

**[1129] The Endeavour of Jean Fernel. With a List of the Editions of His Writings**

Charles Sherrington. Cambridge University Press, 1946. x + 223 pages; 27 illustrations. 22 x 14 cm. 16s. [£0.8]

Part I: The struggle and its aims. Part II: The earliest "physiology." Part III: Success and the close. Appendix: notes, etc. List of editions of the writings of Jean Fernel. Chronology of events. Index.

**[1130] Report on Nutrition in Newfoundland**

D. P. Cuthbertson. Dominions Office. London, His Majesty's Stationery Office, 1947. 87 pages. 24 x 15 cm. 1s. 6d. [£0.075]

Historical introduction. Personal observations: (i) general; (ii) incidence of signs of malnutrition; (iii) background conditions affecting health and nutrition; (iv) food consumption levels and recommendations for their improvement. Summary, discussions and recommendations. Labrador. Acknowledgements. Bibliography. Appendices.

**[1131] Report of the Water Pollution Research Board: with the Report of the Director of Water Pollution Research, 1st July 1939 to 31st December 1945**

Department of Scientific and Industrial Research. London, His Majesty's Stationery Office, 1947. iv + 78 pages; 14 illustrations. 24 x 15 cm. 1s. 3d. [£0.0625]

Report of the Water Pollution Research Board. Report of the Director of Water Pollution Research. (i) Water; (ii) sewage; (iii) industrial waste waters; (iv) polluting effects of sewage and industrial wastes; (v) other investigations. Appendix: publications during the period 30th June 1939 to 31st December 1945 arising out of the work of the Water Pollution Research Board.

**[1131] The Story of Water Supply**

F. W. Robins. London, Geoffrey Cumberlege, Oxford University Press, 1946. x + 207 pages; 31 illustrations. 22 x 14 cm. 18s. [£0.9]

(i) Natural supplies; (ii) the beginnings of conservation; (iii) ancient ponds; (iv) primitive wells; (v) ancient irrigation; (vi) the predecessors of the pump; (vii) Palestine and the Phoenicians; (viii) ancient Greece; (ix) ancient Rome; (x) the Roman Empire; (xi) Roman Britain; (xii) holy wells; (xiii) the dark ages; (xiv) mediaeval water supplies—the monasteries; (xv) mediaeval water supplies (continued); (xvi) old leats; (xvii) kanats; (xviii) well-heads and fountains; (xix) conduits; (xx) early America; (xxi) water sellers and carriers; (xxii) the New River Company; (xxiii) water wheels and wood pipes; (xxiv) water divining; (xxv) the village well; (xxvi) the parish pump; (xxvii) the nineteenth century—and after. Index.

**[1132] Treponematosis**

Ellis H. Hudson. New York, Oxford University Press; London, Geoffrey Cumberlege, 1946. iv + 116 pages. 24 x 16 cm. 12s. 6d. [£0.625]

(i) The parasite; (ii) historical review; (iii) studies in diagnosis; (iv) the "syphiloids". Summary and conclusion. Bibliography.

**[1133] The Evolution of Genetic Systems**

C. D. Darlington. Cambridge, University Press, 1939, reprinted 1946. x + 151 pages; 26 figures. 22 x 14 cm. 12s. 6d. [£0.625]

Preface. (i) Premises of genetics; (ii) the substance of heredity; (iii) sexual reproduction; (iv) meiosis: pairing and crossing-over; (v) meiosis: the process of assortment; (vi) change of quantity: polyploidy; (vii) change of position; (viii) hybrids: diploid and polyploid; (ix) change of proportion; (x) the atom of genetics; (xi) chromosome mechanics; (xii) genotypic control; (xiii) the mechanism of crossing-over; (xiv) the biology of recombination; (xv) the pursuit of hybridity; (xvi) the permanent hybrid; (xvii) the evolution of sex; (xviii) sterility: the contradiction; (xix) apomixis: the escape; (xx) the integration of the cell; (xxi) the evolution of heredity. Bibliography. Index.

**[1133] Animal Genetics and Medicine**

Hans Grüneberg. London, Hamish Hamilton Medical Books, 1947. xii + 296 pages; 33 illustrations. 20 x 13 cm. £1 1s. [£1.05]

(i) Inherited diseases in general; (ii) advantages and limitations; (iii) some principles of developmental genetics; (iv) central nervous system; (v) central nervous system (continued); (vi) central nervous system (continued); (vii) central nervous system (continued); (viii) central nervous system (continued); (ix) central nervous system (continued); (x) the organ of hearing; (xi) the eye; (xii) the eye (continued); (xiii) endocrine organs; (xiv) endocrine organs (continued); (xv) the blood; (xvi) the blood (continued); (xvii) the skeleton; (xviii) the skeleton (continued); (xix) the skeleton (continued); (xx) the digestive tract; (xxi) the urogenital system; (xxii) the skin; (xxiii) serology; (xxiv) disease resistance; (xxv) conclusions. Bibliography. Author index. Subject index.

**[1134] The Louse. An Account of the Lice which Infest Man, Their Medical Importance and Control**

Patrick A. Buxton. Second Edition. London, Edward Arnold & Company, 1947. viii + 164 pages. 47 illustrations. 22 x 14 cm. 10s. 6d. [£0.525]

(i) The Anoplura or sucking lice; (ii) the anatomy of *Pediculus humanus*; (iii) the biology of *Pediculus humanus*; (iv) the medical importance of *Pediculus humanus*; (v) the control of lice; (vi) the crab louse (*Phthirus pubis*). Appendix. References. Index.

**[1135] Medicine. Volume I: The Patient and his Disease**

A. E. Clark-Kennedy. Edinburgh, E. & S. Livingstone, Ltd., 1947. xii + 383 pages. 24 x 16 cm. £1

(i) Body and mind; (ii) symptoms; (iii) symptoms and signs; (iv) heredity and environment; (v) reactions of the body and the mind; (vi) the nature of disease. Summary.

**[1136] The Psychology of the Unwanted Child**

Agatha H. Bowley. Edinburgh, E. & S. Livingstone Ltd., 1947. xi + 112 pages. 19 x 12 cm. 6s. [£0.3]

(i) The essentials of good personality development; (ii) the causes and effects of emotional rejection; (iii) a study of children in substitute homes; (iv) remedies and methods of readjustment; (v) some psychological aspects regarding the care of children in homes. Appendix. Suggestions for further reading. Glossary. Index.

**[1137] Retinal Structure and Colour Vision**

E. N. Willmer. Cambridge University Press, 1946. xii + 231 pages; 5 plates; 77 text-figures. 14 x 22 cm. £1 1s. [£1.05]

Foreword. Preface. (i) The structure of the retinal elements; (ii) the function of the retinal elements; (iii) the spectrum in terms of rod and cone sensitivity; (iv) the C.I.E. colour chart and a possible interpretation; (v) impulse frequencies in retinal nerve fibres and the perception of colour; (vi) the trichromatic basis for colour perception, and the perception of colour at the fovea centralis; (vii) certain aspects of colour-blindness. Addendum. General statement of the theory. References. Notes on the construction of the colour chart. Author index. Subject index.

**[1137] Researches on Normal and Defective Colour Vision**

W. D. Wright. London, Henry Kimpton, 1946. xvi + 383 pages; 233 illustrations. 15 x 25 cm. £1 16s. [£1.8]

Part I. Introduction. (i) The visual organ and visual processes; (ii) visual perception. Part II. The colorimetric equipment. (iii) The principles, design and construction of the colorimeter; (iv) the operation of the colorimeter. Part III. The luminosity curve. (v) The spectral sensitivity of the fovea and extra-fovea in the Purkinje range; (vi) luminosity measurements with very restricted fields; (vii) the interpretation and application of the mixed scotopic-photopic luminosity curves. Part IV. Colour mixture. (viii) The principles of colour measurement on the trichromatic system; (ix) the re-determination of the trichromatic coefficients of the spectral colours; (x) the re-determination of the mixture curves of the spectrum; (xi) the physiological implications of the colour mixture data; (xii) some miscellaneous colour matching data. Part V. Discrimination. (xiii) The sensitivity of the eye to differences in saturation; (xiv) the sensitivity of the eye to differences in hue; (xv) the sensitivity of the eye to differences in chromaticity; (xvi) the analysis of discrimination data; (xvii) the effect of adaptation on the size of the discrimination step. Part VI. Adaptation. (xviii) The principles of binocular matching; (xix) direct adaptation using white adapting stimuli; (xx) direct adaptation using coloured adapting stimuli; (xxi) the derivation of the spectral sensitivity curves of the three-response theory from adaptation experiments; (xxii) indirect adaptation using white adapting stimuli; (xxiii) the measurement of subjective brightness. Part VII. Defective colour vision. (xxiv) The nature, classification and incidence of defective colour vision; (xxv) anomalous trichromatism; (xxvi) dichromatism; (xxvii) monochromatism; (xxviii) the colour-blindness of the central fovea; (xxix) the interpretation of colour-blindness data. Part VIII. The fundamental response curves. (xxx) The interpretation of colour vision phenomena in terms of the fundamental response curves. Index.

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# Shorter Notices

## Vitamine, Hormone, Fermente. Ein Buch für Ärzte, Biologen und Studierende

Rudolf Abderhalden. Dritte Auflage. Basel, Benno Schwabe & Co. Verlag, 1946. 250 pages. 22 x 15 cm. Sw. fr. 14.50

In the words of the author "the object of this book is to assess the present position in the vast field of vitamin- hormone- and enzyme-research". Throughout the work the close relationship which exists between members of the three groups of "bio-catalysts" is emphasized. All the principal and some of the lesser-known substances are dealt with. Each chapter is divided into paragraphs headed as follows : properties, chemistry, physiology, methods of assay, occurrence, clinical use and available preparations. The two latter aspects are treated very briefly, attention being focussed on the physiology of the substance concerned. The author points out that he has ignored theories and speculations, however tempting, and has confined himself to facts alone.

This book should be of use to all who are interested in this rapidly-progressing field without being able to follow the course of research in detail. It is hoped that the physician, being acquainted with the physiological properties of the vitamin-, hormone- and enzyme-preparations he uses, will be a better judge of their therapeutic value, so that disappointments, which already tend to discredit certain aspects of this field, may be avoided.

I. J. L.

## La linfogranulomatosis inguinal subaguda o cuarta enfermedad venerea

Enrique Alvarez Sainz de Aja. Madrid, Gráficas González, 1946. 70 pages; 8 figures. 19 x 13 cm.

This pamphlet is addressed not to specialists but to general practitioners who may encounter cases of lymphogranuloma inguinale in daily practice. The author deals with the questions of contagion, incubation, clinical manifestations, symptoms, diagnosis, treatment and prognosis. The pamphlet is illustrated by eight photographic plates.

## Lo que todo el mundo debe saber sobre la sífilis

Enrique Alvarez Sainz de Aja. Madrid, Gráficas González, 1946. 67 pages. 19 x 13 cm.

This pamphlet is addressed to the general public and to young people in particular and describes in plain and simple language the clinical manifestations, symptoms and prognosis of syphilis in its various stages. The author gives valuable information and advice regarding treatment available.

## 101 Clinical demonstrations to nurses

Hamilton Bailey. Second edition. Edinburgh, E. & S. Livingstone Ltd., 1946. 136 pages; 137 illustrations. 21 x 14 cm. 10s. 6d. [£0.525]

This book comprises brief accounts of 101 common clinical conditions with accompanying illustrations, mostly in colour. It should prove a useful aid to any nurse whether working in the wards or outpatient department. Granted that the surgeon should take every opportunity of demonstrating clinical cases to the nurses who are assisting him, there will be many conditions of which the opportunity of demonstration will be lacking, and this book certainly helps to fill the gap.

The clinical descriptions are simple and concise, and the illustrations for the most part excellent.

Z. C.

## Les septicémies à staphylocoques

M. Barléty & H. Brocard. Paris, J.-B. Baillière, 1945. 252 pages. 24 x 16 cm.

This book on staphylococcal septicaemia opens with a brief historical account of the work done on

the subject. This is followed by a full discussion of the etiology of the condition, subdivided under the headings : the microbe ; and the original focus of infection. The next part covers the clinical manifestations, subdivided into sections on hyperacute forms, acute forms, subacute forms, chronic forms, special forms in children and diabetes and forms associated with certain infectious diseases. Chapters on diagnosis, prognosis, pathology and pathogenesis follow. The final chapter deals with all aspects and types of treatment ; a section entitled "mycotherapy" is devoted to penicillin, and the chapter closes with concise indications to the practitioner as to the best method of treatment according to the type and severity of the infection. There is a bibliography of over 400 references, an index of authors quoted, and a subject index.

A. H.-S.

## Practical methods for the microbiological assay of the vitamin B complex and essential amino acids

E. C. Barton-Wright. London, Ashe Laboratories, Ltd., [1947]. 58 pages. 7s. 6d. [£0.375]

The importance of the vitamins, if not of the amino-acids, in ensuring good health has become common knowledge. On the strength of their health-providing qualities, many food-products are purchased without question of their real vitamin-content. Under on order of the Ministry of Food, manufacturers of food-products must indicate the content in their products of certain of the vitamins. For this purpose speedy and precise methods of determination are essential. Microbiological methods of assay go a long way in fulfilling this purpose.

In his book, Dr. Barton-Wright gives details of microbiological assays of riboflavin, nicotinic acid, ascorbic acid, biotin, pyridoxine and pantothenic acid and eleven essential amino-acids. This he does with clearness and simplicity, and he indicates carefully the precautions to be adopted with each method. In fact, few should have any difficulty in following his instructions. They might, however, have been prefaced by a few remarks on bacteriological technique for the benefit of those working with bacteria

## BOOK REVIEWS

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### [1138] Report of the Governing Body, 1947

The Lister Institute of Preventive Medicine. London, The Lister Institute of Preventive Medicine, 1947. 12 pages. 25 x 19 cm.

### [1144] Una Epidemia de Peste Bubónica en el Siglo XVI

José Vives Ibarrola. Pamplona, Editorial Aramburu, 1947. 133 pages. 21 x 14 cm.

(i) La peste en Pamplona ; (ii) una berría sanitaria ? ; (iii) estudio medico de la peste bubónica en el siglo XVI ; (iv) epidemiología ; (v) el factor social ; (vi) profilaxis ; (vii) comparación con la epidemia de Milan, de 1630 ; (viii) los actos religiosos en la profilaxis de la peste ; (ix) otras actuaciones complementarias.

### [1145] The Renaissance and its Influence on English Medicine, Surgery and Public Health

Sir Arthur Salisbury MacNalty. London, Christopher Johnson, 1946 ; 30 pages ; 3 illustrations. 22 x 14 cm. 5s. [£0.25]

### [1146] Doctors Differ. Five Studies in Contrast

Harley Williams. London, Jonathan Cape, 1946. 253 pages. 8 illustrations. 20 x 14 cm. 12s. 6d. [£0.625]

Part I : Prologue. Part II : John Elliotson (1791-1868), his triumph and his defeat. (i) John Elliotson ; (ii) apprenticeship ; (iii) Cobbett's pupil ; (iv) medical teacher ; (v) the first mesmerist ; (vi) showing the world ; (vii) more experiments ; (viii) the opposition ; (ix) at 35 Bedford Square ; (x) Wakley gives judgment ; (xi) disgrace ; (xii) worshipping students ; (xiii) journalism to the rescue ; (xiv) surgeons and others ; (xv) Latin abandoned ; (xvi) James Braid ; (xvii) an honest man ; (xviii) was he right ? ; (xix) after Elliotson. Part III : Hugh Owen Thomas and the making of orthopaedics. (i) Rural healers ; (ii) young Dr. Thomas ; (iii) the bonesetters ; (iv) an agnostic's faith ; (v) the torch carried on ; (vi) enters the nurse ; (vii) orthopaedics is born. Part IV : James Mackenzie and William Osler. (i) James Mackenzie ; (ii) talent for research ; (iii) the highland boy ; (iv) heart troubles ; (v) heart medicine ; (vi) the young Osler ; (vii) Regius Professor ; (viii) Mackenzie moves to Harley Street ; (ix) the wise physician ; (x) research strenuous ; (xi) opposite prototypes. Part V : William MacEwen and the story of the brain. (i) Lister and MacEwen ; (ii) early brain knowledge ; (iii) mapping the brain ; (iv) the brain atlas ; (v) chest surgery ; (vi) professor of surgery ; (vii) Victor Horsley ; (viii) Gulielmus Superbus ; (ix) the brain in the future. Part VI : Robert William Philip and Edward Livingstone Trudeau. (i) Back to the Pyramids ; (ii) the Breton genius ; (iii) the marvellous Koch ; (iv) Koch's inspiration ; (v) fresh air ; (vi) fresh air in the city ; (vii) the forest healer ; (viii) the original clinic ; (ix) the medical statesman. Part VII : Epilogue : Rembrandt's picture.

### [1147] The Rotunda Hospital 1745-1945

O'Donel T. D. Browne. Edinburgh, E. & S. Livingstone Ltd., 1947. xx + 296 pages ; 44 illustrations. 25 x 19 cm. £2 2s. [£2.1]

Part I. The first hundred years. Part II. The second hundred years. Part III. The struggle against puerperal fever. Part IV. Operative midwifery. Part V. Anaesthesia and gynaecology. Part VI. Eclampsia. Synopsis. Index. Graph.

for the first time. To this might also have been added a note on the work still needed to be done on the basal media used in microbiological assays. However, Dr. Barton-Wright's book should stimulate many to explore the analytical uses of micro-organisms to the extent that they have been in the USA, and it may provide a basis for the standardization of microbiological assays of vitamins and other substances.

### Übersicht der gebräuchlichen und neueren Arzneimittel für Ärzte, Apotheker und Zahnärzte

E. Bernoulli & J. Thomann. Sechste neu bearbeitete Auflage. Basel, Benno Schwabe & Co. Verlag, 1946. xii + 568 pages. 18 x 12 cm. Sw. fr. 13.50

As pointed out in the foreword to this Swiss materia medica, "For many doctors modern therapy means the prescription of proprietary drugs." Accordingly, the less-expensive pharmacopoeial forms of proprietary drugs are given wherever possible. Where it has been necessary to choose among proprietary drugs, preference has been given to those more readily available in Switzerland at the time this survey was made. Remedies are grouped comparatively, under the main headings of substances acting on the nervous, circulatory, respiratory, digestive and genito-urinary systems, and those affecting metabolism, infectious diseases, skin and mucous membrane. The concluding sections of this convenient and useful handbook describe the various forms in which preparations are obtainable, give prescriptions (again grouped according to systems), and list the most important maximum doses, and the most important drugs, with the preparations prepared from them, according to the *Pharmacopoea Helvetica*. Indexes are included of conditions for which drugs are indicated, and of the drugs themselves.

H. P.

### Estudos cirúrgicos. 4a série

Eurico Branco Ribeiro. São Paulo, Livraria Atheneu José Bernades, 1945. 280 pages; illustrations. 24 x 16 cm.

Dr. Ribeiro is director of the Sanatório São Lucas, and in this book he deals with a variety of surgical problems of which he has had practical experience, including plastic surgery, pyloric ulcer, of the anterior wall of the stomach, post-operative contingencies, etc. Illustrative case-histories of a number of patients treated at the Sanatório São Lucas are given with descriptions of operative methods. The book contains photographic and diagrammatic illustrations.

### Manual de alergia. Para el médico general

Milton B. Cohen. Versión directa del original inglés por el Dr. J. M. Cañadell. Barcelona, Ediciones Byp, 1947. 107 pages. 20 x 14 cm.

This is a translation from the original published in English in the USA and is addressed to general practitioners. The book includes a definition of allergy and chapters on its classification into different types, its clinical manifestations, diagnosis, treatment, some important allergens, allergic rhinitis, asthma, and serological reactions.

### Chemotherapy yesterday, to-day, and to-morrow. The Linacre Lecture 1946

Alexander Fleming. Cambridge University Press, 1946. 39 pages; 7 illustrations. 18 x 13 cm. 2s. [£0.1]

In this lecture Sir Alexander Fleming reviews briefly the early work on chemotherapy of bacterial

infections and the events leading to the discovery of the sulphonamides and of penicillin, and gives some description of the properties and production of these substances. After a lucid résumé of these "chemo-therapeutic happenings" in which he himself has played so large a part, he describes briefly some of the other antibiotics recently introduced (gramicidin, tyrothricin and streptomycin), and indicates possible future developments. He concludes by an appeal for the foundation of a central institute for fundamental research in microbiology, which he describes as "the most important chemotherapeutic want in Britain at the moment." Such an institute would co-ordinate the work of investigators in many related fields and would provide facilities for research and development; had these been available in 1928, penicillin might not have had to wait 10 years. Should this appeal bear fruit, it would be a fine growth from the generous and far-sighted foundations of Linacre.

The Cambridge University Press publishes the lecture in this small paper-bound pamphlet with five clear diagrammatic illustrations (defaced, however, by one misprint in fig. 3) and two plates.

H. P.

### The care of children from one to five

John Gibbens. Third edition. London, J. & A. Churchill Ltd., 1947. vii + 192 pages; 7 illustrations. 18 x 11 cm. 5s. [£0.25]

*The care of children from one to five*, by Dr. John Gibbens, is written in the same attractive conversational style as its predecessor, *The care of young babies*. The whole field of the development and care of the young child is covered in a most admirable way.

Unusual features are chapters dealing with such things as books and music, holidays, treats and picnics, the problem of sex and the care of young children in the tropics. Chapters have also been added on First Aid and the Care of the Sick Child.

This third edition, which has been almost entirely re-written, can be strongly recommended to mothers, nurses, and doctors in general practice.

### Primeros cuidados a un accidentado

L. Gubern Solísachs. Barcelona, Ediciones Byp, 1946. 83 pages; 65 figures. 20 x 14 cm.

The first chapter of this book gives illustrative case-histories of injuries aggravated, in some instances fatally, by careless, inadequate or unskilled first-aid. The author goes on to indicate the correct first-aid treatment for various injuries and for shock, methods of artificial respiration and improvised transport for emergencies. He further gives useful information on what to avoid in applying first-aid treatment.

### An approach to social medicine

John D. Kershaw. London, Baillière, Tindall and Cox, 1946. x + 329 pages. 22 x 14 cm. 15s. [£0.75]

The title of this book is to be taken literally. It is concerned with the development of a particular attitude towards medicine and towards society. While every good practitioner is actively concerned with the development of medicine in relation to social life, too few have accepted the challenge that medicine (among other agencies) must take an active part in influencing social activities in the interests of human well-being.

In order to make an appraisal of the disorders and disharmonies from which it suffers, Dr. Kershaw reviews the anatomy and physiology of society. He next discusses the developments of the major branches of medicine in relation to social activities. Finally, he considers some of the more urgent health-problems which society has created. Social medicine is a

philosophy of health, and the last chapter appropriately deals with the human and social instruments of that philosophy.

In spite of its theoretical preoccupations this is a practical work, and is recommended not only to all medical men but also to those who claim to be intelligent, responsible citizens, for it is to this larger audience that the author makes his appeal. The succinct and necessarily dogmatic review of such a wide territory (with all its sins of commission and omission) satisfies a very real need of the average doctor, and the more enquiring are catered for in an excellent and ample bibliography.

R. Scott

### L'année médicale pratique. 24e année

Édité par Prof. Camille Lian. Paris, Editions R. Lépine, 1945. xvii + 471 pages. 17 x 11 cm. Fr. 177

This annual is published under the general direction of Professor Camille Lian of the Hôpital Tenon, assisted by an editorial board of specialists in the various subjects covered. Its object is to extract the "marrow" from the medical literature of the past year and to present it in a condensed form for the benefit of medical practitioners who lack the time to assimilate the mass of published material, but who nevertheless need to know the important advances that have been made. The articles on each subject are written by specialists, who sift the material carefully, including only those points which are likely to be of real and practical importance to their readers, and present them in such a way that recourse to the original articles is unnecessary. While the emphasis is naturally placed on French work, important foreign contributions are noted as far as possible.

The main part of the journal consists of these articles arranged in alphabetical order, preceded by a classified list of titles. In addition there are: (a) a list of the most important new proprietary preparations of the past year, with in each case a brief description, and indications and directions for use; (b) an index of the principal manufacturers of proprietary drugs; (c) a list of the principal new apparatus and instruments; (d) a list of the chief medical books published during the year, under alphabetical subject-headings; and (e) an index to the articles in the main section.

A. H. S.

### Handbook of physiology and biochemistry

R. J. S. McDowell. Thirty-ninth edition. London, John Murray, 1946. xii + 853 pages; plates; 305 figures. 21 x 14 cm. £1 5s. [£1.25]

The first edition of this book appeared in 1848, its author was W. S. Kirkes of St. Bartholomew's Hospital, London, assisted by Mr. (afterwards Sir) James Paget, the lecturer in physiology at the hospital. The succeeding 8 editions were undertaken by different members of the hospital staff. In 1896 the 14th edition was undertaken by W. D. Halliburton of King's College, London, who brought out 17 editions in the next twenty-nine years. He was joined in 1928 by the present editor, and together they produced the 31st edition. Since 1930 R. J. S. McDowell alone has been responsible and has initiated 8 more editions.

The continued phenomenal success of this handbook cannot be attributed merely to tradition. In these days of expansion it is gratifying to notice that the present edition contains only 153 more pages than the original edition of 1848. A student's textbook should be a guide and not an encyclopedia. In the reviewer's opinion, the author has quite correctly endeavoured to explain as simply as possible,

with the aid of some 300 illustrations, all that a student can be reasonably expected to know who studies physiology for five terms up to an ordinary degree standard. To avoid any misapprehension on this score, a test was made as follows. A recent 2nd M.B. physiology paper was chosen at random and the text relating to the specific material carefully read. There was no doubt in the reviewer's mind that from that standpoint the book was an unqualified success.

C. C. N. Vass

### The science of seeing

Ida Mann & A. Pirie. Harmondsworth, Penguin Books (Pelican Books), 1946. 18 x 11 cm. 1s. [£0.05]

This is a competent presentation of several significant aspects of vision and its anomalies. Professor Ida Mann has contributed a series of delightful chapters dealing with the structure, development, and comparative anatomy of the eye, and on pathological disturbances. Miss Pirie has been responsible for the section with a biochemical bias, such as the excellent chapters on The Retina and Visual Purple, and on Cone Cells and Colour Vision, and that on Vision and Vitamins. The concluding chapters on Ocular Hygiene, the Blind Population and Ophthalmic Services complete an authoritative and balanced presentation.

### L'œuvre des Pasteurs en Afrique Noire. Afrique Occidentale Française

Constant Mathis. Paris, Presses Universitaires de France, 1946. xi + 580 pages; illustrations. 22 x 14 cm.

The author's object in writing this interesting book is to give an account of the part played by Pasteur workers in combating some of the dread diseases of Africa. The period covered is from the year 1896, when the first Pasteur Institute in Africa was founded at St. Louis du Sénégal, to 1937 when the new Pasteur Institute was opened at Dakar. The book is in 7 parts, the first being a short historical sketch of the Pasteur Institutes in French West Africa. The 2nd and 3rd parts are devoted to an account of the directors who worked there throughout the period covered by the book, and to an account of Pasteur workers who have performed special missions in Africa. Part 4 deals with diseases prevalent in the country, and the measures taken to eliminate them or to reduce their toll of life. Part 5 gives an account of the Pasteur Institute at Kindia, its aims, organization and work. Parts 6 and 7 are devoted to the work of the Pasteur Institutes in Africa in the field of veterinary medicine. In conclusion the author sums up the immense benefit which the work of the Pasteur Institutes in Africa has been to the people of the country.

V. E. C. M.

### Les contagions de la syphilis

G. Millian. Paris, Baillière et Fils, 1946. 205 pages; 28 figures. 24 x 16 cm.

This book, by a member of the Académie de Médecine, on the various ways in which syphilis is propagated, is based on wide clinical experience supported by an extensive study of the literature. The author quotes numerous illustrative cases, many of them having come under his own observation. The book is divided into four parts, of which the first occupies over half the book. The first chapter deals with the varying degrees of contagiousness at different stages of the disease. This is followed by a chapter covering modes of contagion and social sources, together with a note on the question of whether syphilis in the colonies was indigenous or imported by Europeans. The third chapter is a short one devoted to a description of

*Trepanema pallidum*, and is followed by a long chapter in which the author discusses fully the problems of reinfection and superinfection, or "supersyphilization". The first part of the book closes with a short chapter on syphilis in animals. The second and third parts are devoted to the various aspects of hereditary syphilis, and the fourth to the question of immunity: natural, acquired and experimental.

The book is illustrated with numerous photographs. There is no collected bibliography, but references are given in the text or as footnotes.

A. H.-S.

### A practical handbook of psychiatry for students and nurses

Louis Minski. London, Wm. Heinemann (Medical Books) Ltd., 1946. 128 pages. 19 x 12 cm. 6s. [£0.3]

The author of this book has attempted an almost impossible task. In 16 chapters comprising only 120 pages he has tried to cover the vast range of modern psychiatry for the benefit of the medical student and the nurse. Special chapters, for instance, are given to occupational therapy and rehabilitation, the newer physical methods of treatment, psychotherapy and child psychiatry. Legal aspects of psychiatry, the psychoneuroses, nursing and general management, the etiology of mental disease and the various psychiatric syndromes are all discussed. The chapters on physical treatments and occupational therapy and rehabilitation give a reasonable outline of these newer developments, but psychotherapy and child psychiatry are dealt with in chapters of only four pages each and are decidedly sketchy.

Readers of this book will get a bird's-eye view of the variety and scope of modern psychiatry. And if it does not satisfy fully the needs of either the nurse or the student, it may encourage those who read it to an increased interest in this rapidly-developing branch of medicine. Views expressed are definite and very much to the point. One or two statements of fact need correction, such as that pethidine has not the habit-forming characteristics of the opium alkaloids.

### A textbook on the nursing and diseases of sick children for nurses by various authors

Edited by Alan Moncrieff. Fourth edition. London, H. K. Lewis & Co. Ltd., 1947. xiv + 744 pages; 144 illustrations. 22 x 14 cm. 30s. [£1.5]

At the end of this book the questions set at the final State examination for the supplementary part of the Register for Sick Children's Nurses for 1943 and 1944 are reproduced. These show the standard of knowledge required and the fourth edition of this well-known textbook does cover the ground required in a lucid and balanced manner. Professor Moncrieff has enlisted the aid of eleven contributors, all except two being members of the staff of The Hospital for Sick Children, Great Ormond Street. This book may, therefore, be said to reflect the teaching of that hospital.

In the nursing section, consideration is given to the care of the child in health as well as in disease, and orthopaedic surgery is described in detail. The second part of the book deals with diseases of children, and the various medical and surgical disorders and diseases are described in a comprehensive and orderly manner. The care and management of children in the tropics and their commoner diseases form the subject of the last chapter.

There is a most useful appendix dealing *inter alia* with pharmacology and therapeutics, nursing, recipes, physiotherapy, x rays, radium and medico-social work in a children's hospital.

The book can be confidently recommended to the nursing profession, not only for examination purposes, but also as a reliable and up-to-date text book on paediatrics.

J. M. S.

### Medizinische Mikrobiologie. Parasiten, Bakterien, Immunität

Reiner Müller. Dritte, vermehrte Auflage. Berlin-München-Wien, Urban & Schwarzenberg, 1946. ix + 488 pages. 25 x 17 cm.

Austerity is the keynote of this work by Prof. Müller of Cologne. It contains very few illustrations, and these are only diagrammatic, and space is saved by including very little tabular matter, by the extensive use of small type, and by innumerable abbreviations. The book is divided into the three sections named in the title. The first is an independent whole, and entirely adequate, except that in the absence of any illustrations it must be very difficult for the student to form any clear ideas about such animal parasites as he cannot see for himself. The primary classification of bacteria in the second section is on a very simple morphological basis, separating them into only five groups: succeeding sections deal with viruses and fungi. The last-named section appears a better place for the *Actinomyces* than among the gram-positive bacilli, where they are actually described. The last section, on immunity, is more comprehensive than usual, and includes information about methods of immunization against particular infections which it is more usual to include with the description of the micro-organism concerned. There is much to be said for dealing with every aspect of each infection, including this one, in a single chapter, and making those on immunity more general and theoretical. The author has evidently been fortunate in obtaining access to the wartime literature of other countries, and much important recent work is mentioned. Sometimes it is no more than mentioned: for example, Lancefield's groups and Griffith's types of haemolytic streptococci are referred to, but with no hint of the practical uses of these classifications in epidemiological studies. The book contains a large amount of accurate information, but it is not in an easily-assimilable form.

### The art of nursing

Florence Nightingale. Revised edition. Claud Morris Books Ltd., 1946. 52 pages; 1 plate. 18 x 12 cm. 6s. [£0.3]

Miss Nightingale's book *Notes on nursing*, written in 1859, has long been out of print and it is a pleasure to see it again, this time under a new title and with the text slightly expurgated.

The book is so full of deep understanding and shrewd commonsense that it is difficult to make selections for purposes of illustration. Her comments on the importance of accurate observation set a very high standard; she writes, "Is it not to be feared that observation as an essential part of medicine has been declining? 'There must have been some appearance had I but looked; let me try and remember what there was, that I may observe another time.' No, this is not what people say. They boldly assert that there was nothing to observe, not that their observation was at fault."

She understood occupational therapy eighty years ago. "Now you can have no idea of the relief manual labour is to you—of the degree to which the deprivation of manual employment increases the peculiar irritability from which the sick suffer. A little needlework, a little writing, a little cleaning would be the greatest relief the sick could have, if they could do it." Likewise, her stress on preventive work is apparent in every chapter.

Many readers will be surprised at the vigorous and witty style entirely free from Victorian sentiment.

On the subject of ventilation she writes "Windows are made to open; doors are made to shut—a truth which seems extremely difficult of apprehension." The publishers are to be congratulated on this attractive volume; the book is applicable to modern conditions because it deals with fundamental matters. It shows Miss Nightingale's amazing grasp of practical nursing detail combined with her outstanding administrative ability and political vision.

### The birth of a child. Obstetric procedure in normal childbirth for those who attend women in labour

Grantly Dick Read. London, Wm. Heinemann (Medical Books) Ltd., 1947. viii + 99 pages. 18 x 12 cm. 5s. [£0.25]

The birth of a child by Grantly Dick Read is intended as an explanation, in simple non-technical language, of the author's methods for the relief of pain in childbirth by natural means. It consists, in the main, of a collection of papers published elsewhere with, in addition, the text of a lecture given to a medical society, some lecture notes, and personal accounts from patients who have found his methods successful. Inevitably there is a good deal of repetition, which is rather tiresome. The book, however, serves as a very useful introduction to the author's larger work, *Revelation of childbirth*. The lay reader, on the other hand, will find in its pages sufficient information for his purpose.

### Surgical note-taking. A booklet for surgical dressers and clerks commencing clinical studies

Charles F. M. Saint. Fourth edition. London, H. K. Lewis & Co. Ltd., 1947. vii + 106 pages. 18 x 12 cm. 4s. 6d. [£0.225]

This little book has stood the test of time and has proved its worth to several generations of students. The average student takes very bad notes of his cases and should have such a book as this near at hand to help him in the difficult task of accurate observation. The illustrative cases serve as very good examples of note-taking and make the book more readable. Altogether a useful and practical book.

Z. C.

### Eye surgery

H. B. Stallard. Bristol, John Wright & Sons Ltd., 1946. ix + 444 pages; 338 illustrations. 22 x 14 cm. £2. 10s. [£2.5]

This work is a balanced survey of modern practice, even if it errs slightly in giving more on plastic surgery than most ophthalmic surgeons undertake. For the rest, the postgraduate student for whom the book is intended has clear and detailed instructions. Alternative methods are fully discussed, though the text is remarkably free from accounts of obsolete procedures. Since operating is an art—though an art based on science—the experienced surgeon can readily find passages in the text from which to dissent. More significantly, the book can be recommended as a straightforward account of "good, sound and honest practice"—to use a tribute that the author pays to his own teachers.

### Meningitis meningocócica en la infancia: (meningitis cerebroespinal epidémica)

Walter Sümmann. Traducción directa del alemán, notas y apéndice por el Dr. A. Ballabriga Aguado. Barcelona, Ediciones Byp, 1947. 112 pages. 20 x 14 cm.

This is a translation from German which deals with the epidemiology of meningitis; meningitic infections in infants, young children, and children of school age; sequelae; serous meningitis; and

the therapeutics of meningitic infections. In the first chapter the author discusses the problem of infection, i.e. whether a predisposition of congenital origin may exist or whether some injury at birth or in the early days of a child's life may be a contributing factor. The author also discusses the difficulties of diagnosis in children at various ages, and symptoms and prognosis. He comments on the decline in mortality due to modern chemotherapy, and states that in recent cases he has seen no mental sequelae.

### Spiders, ticks and mites: including the species harmful to man in Australia and New Guinea

F. H. Taylor & R. E. Murray. Sydney, School of Public Health and Tropical Medicine (University of Sydney), Commonwealth Department of Health, 1946. 275 pages; 185 illustrations. 24 x 14 cm.

The war in New Guinea brought many Australians into contact with diseases carried by insects, mites and ticks, and made them generally aware of the problems concerning dangerous arthropods. This book is intended to meet the interest which has been aroused, and to give information to those in isolated districts.

The first 234 pages deal with the systematics of the arachnids which may be harmful to man, and give data for the identification of the species. It is difficult to believe that this information will be of value to those who have not had a biological training, and without special experience, even a medical officer is unlikely to be able to make full use of keys or to be able to identify all the mites which are described. On the other hand, although little of the information is new, much of it is rather inaccessible, so scientific workers in New Guinea or northern Queensland should find this volume of considerable help, although there are many minor inaccuracies, especially in the section on Trombiculid mites.

The second section, of 38 pages, deals with the medical side of the problem. A third of the space is devoted to a useful account of the effects of bites of venomous spiders, with case-histories of a fair proportion of those which have occurred in Australia. A similar amount of space is given to tick paralysis. "Q" fever, which is believed to be carried by ticks, is not mentioned at all. Irritation caused by mites is described, and there is a full account of human scabies. Mite-borne typhus, though of so much importance in the war in the Pacific, is hardly mentioned at all.

Although it is claimed in the preface that "this book has been compiled so that it may be of service to the man on the land, the medical practitioner and the public in general," it was obviously planned and written during the war (the foreword is dated July 1945) and intended to be of use to military health authorities in the field. To be of more general use it requires replanning, particularly in the light of new information which was secret during the war and has now been released.

Kenneth Mellanby

### Principles of the contact lens

H. Treisman & E. A. Plaice. London, Henry Kimpton, 1946. vii + 83 pages; 40 illustrations. 23 x 14 cm. 10s. 6d. [£0.525]

This book is designed to instruct the clinical ophthalmologist in the principles of the contact lens. A general description of contact lenses is followed by a brief optical revision and a discussion of the main indications for their use. The various types of lenses available are described and an account is given of the preliminary test which shows how contact lenses will help any particular case. The book ends with some discussion about tolerance, and the instruction of the patient in insertion and

removal of the lenses. No details are given about the technique of the fitting or the manufacture of the lenses which are not the responsibility of the ophthalmologist. The book is well written and clearly illustrated, and fully achieves its stated purpose.

A. G. Cross

### Elements of surgery

Faust: Welsh. London, Geoffrey Cumberlege, Oxford University Press, 1947. viii + 83 pages. 19 x 12 cm. 7s. 6d. [£0.375]

This book contains the substance of lectures given to nurses and will certainly be a useful help to first-aid workers and nurses. We hardly think that the author's hope that the book might also be useful to medical students is justified. The information given is accurate enough (though there are several minor inaccuracies), but it is fragmentary, ill-arranged, and does not give that sufficient emphasis on principles which is so essential for the medical student commencing the study of surgery. The author describes the chief characteristics of microbes without saying a word about antiseptics; and he gives an account of gangrene, haemorrhage and shock before dealing with the most important question of wounds. In the section dealing with the treatment of acute inflammation he mentions the giving of drugs by mouth or by injection "such as the sulpha drugs or penicillin" without giving any indication of the revolution in treatment brought about by the last-mentioned drug.

If this book is to be of real use to medical students it will need to be re-cast and enlarged. As an accompaniment to lectures to nurses it will no doubt prove very helpful. Several mistakes in spelling escaped correction.

### Womanhood

Margaret Moore White. London, Cassell & Company Limited, 1947. 107 pages; 30 figures. 22 x 14 cm. 7s. 6d. [£0.375]

Womanhood, by Margaret Moore White, is written in simple, clear language. It should prove useful to the engaged girl and newly-wed wife, as well as to the mother who wishes to explain to her growing daughter certain of the developing processes in her body.

As the space available for dealing with Bottle-feeding and the Problems of Infancy and Early Childhood is necessarily very limited, it might have been well to have made only a passing reference to the first and to have omitted the second. There are many excellent books now available dealing with all aspects of infant-care.

On the whole this is an excellent book and could be recommended, although one or two opinions are expressed from which the lay reader's own medical adviser may differ.

### X-rays

B. L. Worsnop & F. C. Chalkin. Second edition. London, Methuen & Co. Ltd., 1946. vii + 126 pages; 47 illustrations. 17 x 11 cm. 5s. [£0.25]

In the preparation of the second edition of his monograph on x rays, Dr. Worsnop has enlisted the help of Dr. Chalkin. Together they have succeeded in producing a clear, compact work on the physics of x rays. It should prove both of value and interest to the two classes of medical readers most concerned, namely the practising radiologist and the radiological student. The former will be shown what is new and reminded of much that he has forgotten; whilst the latter will be provided with a readable, straightforward and simple account of a subject usually considered tedious by doctors.

M. Lederman

### The human approach. A book for medical students

Henry Yellowlees. London, J. & A. Churchill Ltd., 1946. vii + 189 pages. 21 x 14 cm. 10s. 6d. [£0.525]

Designed as an introduction to psychological medicine, this book never loses sight of the fundamental doctor-patient relationship and would be sound preliminary reading for any students preparing for work involving human relationships. It is addressed to medical students just entering the clinical period of their training, in which is introduced "an entirely new factor—namely, human nature." Clinical material, the author points out, unlike that in the dissecting room, may lie, sulk, deceive, and announce its opinion of the student.

Dr. Yellowlees, from his large experience of psychiatry and of teaching medical students, describes in straightforward language the psychological mechanisms involved in the problems which face every young doctor. His book is calculated both to arouse interest in specialized medical psychology and to be of fundamental use to all engaged in any form of medicine. It is based on the conception of psychosomatic unity, and reiterates the presence of both psychological and physical factors in all disease and the consequent need for every medical man to have a working knowledge of medical psychology.

Included is a section on Doctor and Lawyer, giving useful information often gained only by the hard way of experience. This is followed by a chapter entitled *Psychiatric Oddities*, which describes some of the unusually difficult people, both patients and their relatives, with whom the student may have to deal, illustrated by amusing anecdotes from the author's own experience. Under The Word "GO" Dr. Yellowlees attempts to reply to the fundamental enquiries of students at the beginning of their course. He suggests that the ideals demanded in the service of science are: humility, intellectual honesty, courage, the enquiring mind—and, added to these, the capacity for wonder. An appendix on sane psychology gives a survey of the situation which prompted the author to write this most readable and stimulating book.

H. P.

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## Books Received

May 1947—September 1947

Many of the books listed will be, or have already been, reviewed in the Bulletin.

Air Ministry. *Handbook of preventive medicine*. (Air publication 1269B.) 1947. His Majesty's Stationery Office, 7s. 6d. [£0.375]

Anderson, J. R. *Ocular vertical deviations*. British Journal of Ophthalmology, Monograph Supplement XII. 1947.

Barbry, M. & Brocard, H. *Les septicémies à staphylocoques*. 1945. Baillière (Paris).

Barraud, A., Nager, F. R., Rüedi, L., Schlittler, E., & Taillens, J.-P., editors. *Lehrbuch der Hals- & Nasen-Ohren- und Mundkrankheiten*. 1947. S. Karger (Basel), sw. fr. 60

Beaumont, G. E. & Dodds, E. C. *Recent advances in medicine*. 12th ed. 1947. Churchill, £1 1s. [£1.05]

Binger, C. *The doctor's job*. 1946. Allen & Unwin, 12s. 6d. [£0.625]

Board of Control (England and Wales). *Pre-frontal leucotomy in a thousand cases*. 1947. His Majesty's Stationery Office, 6d. [£0.025]

Brain, W. R. *Diseases of the nervous system*. 3rd ed. 1947. Geoffrey Cumberlege, Oxford University Press, £1 17s. 6d. [£1.875]

British Journal of Surgery. *Wounds of the head*. (War Surgery Supplement No. 1.) 1947. Wright, £1 10s. [£1.5] (Free to subscribers)

British Red Cross Society. *Report for the year 1946*. [1947.] British Red Cross Society

Brunschwig, A. *Rodical surgery in advanced abdominal cancer*. 1947. University of Chicago Press, £2 2s. [£2.1]

Burn, J. L. *Recent advances in public health*. 1947. Churchill, £1 5s. [£1.25]

Cameron, A. T. *Recent advances in endocrinology*. 6th ed. 1947. Churchill, £1 1s. [£1.05]

Chailley-Bert, P. et al. *Aptitude aux sports et contrôle médical*. 2e éd. 1943. Baillière (Paris)

Clark-Kennedy, A. E. *Medicine. Vol. 1. The patient and his disease*. 1947. Livingstone, £1

Clay, H. H. *The solitary Inspector's handbook*. 5th ed. 1942. Lewis, 18s. [£0.9]

Cochrane, R. G. *A practical textbook of leprosy*. 1947. Geoffrey Cumberlege, Oxford University Press, £2 2s. [£2.1]

Collis, E. *A way of life for the handicapped child. A new approach to cerebral palsy*. 1947. Faber, 10s. 6d. [£0.525]

Colson, J. H. C. *The rehabilitation of the injured. Vol. 2. Remedial gymnastics*. 1947. Cassell, £1 10s. [£1.5]

Cornford, J. *Health of the unknown. The story of the Peckham experiment*. 1947. Hamish Hamilton, 7s. 6d. [£0.375]

Crawford, A. M. *Materia medica for nurses*. 6th ed. 1947. Lewis, 5s. 6d. [£0.275]

Cyriax, J. *Rheumatism and soft tissue injuries*. 1947. Hamish Hamilton, £2 2s. [£2.1]

Davidson, L. S. P. & Anderson, I. A. *A textbook of dietetics*. 2nd ed. 1947. Hamish Hamilton, £1 1s. [£1.05]

Dawes, B. *Man and animals, what they eat and why. A manual of nutrition*. 1947. Longmans Green, 7s. 6d. [£0.375]

Department of Scientific and Industrial Research. *Report of the Water Pollution Research Board: with the report of the Director of Water Pollution Research, 1st July 1939 to 31st December 1945*. 1947. His Majesty's Stationery Office, 1s. 3d. [£0.063]

Dewberry, E. B. *Food poisoning: its nature, history and causation, measures for its prevention and control*. 2nd ed. 1947. Leonard Hill, 17s. 6d. [£0.875]

Durán Arrom, D. De G. *Propedeutico de patología circulatoria en las profesiones*. 1947. Ediciones Morata (Madrid), ptas 40

Duthie, E. S. *Molecules against microbes*. (Introduction to Science No. 6.) 1946. Sigma, 6s. [£0.3]

Edge, P. G. *Vital statistics and public health work in the tropics including supplement on the genealogy of vital statistics*. 1947. Baillière, 15s. [£0.75]

Egypt. Ministère de l'Hygiène Publique. *La semaine de l'Egypte pour la lutte contre le cancer, 23-30 Novembre 1938*. 1941. Schindler (Cairo)

Ewart, E. D. *A guide to anatomy: for students of physiotherapy and electrotherapy*. 6th ed. 1947. Lewis, £1 5s. [£1.25]

Ewing, I. R. & Ewing, W. G. *Opportunity and the deaf child*. 1947. University of London Press, 9s. 6d. [£0.475]

Franco, B. B. *Información sobre la lucha anti-tuberculosis en España y memoria correspondiente al año 1944*. 1945. Publicaciones del Patronato Nacional Antituberculosis (Madrid)

Frantz, V. K. & Harvey, H. D. *Introduction to Surgery*. 1946. Oxford University Press (New York), £1 5s. [£1.25]

Fraser, R. et al. *The incidence of neurosis among factory workers*. (Medical Research Council Industrial Health Research Board Report No. 90.) 1947. His Majesty's Stationery Office, 1s. 3d. [£0.063]

Frazer, W. M. *Duncan of Liverpool: being an account of the work of Dr. W. H. Duncan, Medical Officer of Health of Liverpool 1847-63*. 1947. Hamish Hamilton, 8s. 6d. [£0.425]

Gesell, A. & Amatruda, C. S. *The embryology of behavior*. [1947.] Hamish Hamilton, £1 1s. [£1.05]

Gill, G. H. *Dust and its effects on the respiratory system*. 1947. Lewis, 5s. [£0.25]

Gräub, E. *Tuberkulöse Reinfektion beim Rinde*. 1947. S. Karger (Basel)

Groves, E. W. H. *Synopsis of surgery*. Edited by C. P. G. Wakeley. 13th ed. 1947. Wright, £1 5s. [£1.25]

Grüneberg, H. *Animal genetics and medicine*. 1947. Hamish Hamilton, £1 1s. [£1.05]

Guggisberg, H., editor. *Lehrbuch der Gynäkologie*. 2. Aufl. 1947. S. Karger (Basel)

Harvey, W. C. & Hill, H. *Insect pests*. 2nd ed. 1947. H. K. Lewis, 14s. [£0.7]

Heimann, H. L. & Wilson, D. *Nurses' pharmacopoeia and pocket book of useful word information*. 5th ed. 1946. Baillière, 4s. [£0.2]

Hentschel, C. C. & Cook, W. R. I. *Biology for medical students*. 4th ed. 1947. Longmans Green, £1 5s. [£1.25]

Hern, K. M. *Physical treatment of injuries of the brain and allied nervous disorders*. 1947. Baillière, 10s. 6d. [£0.525]

Hill, H. *Pasteurisation*. 2nd ed. 1947. Lewis, £1 1s. [£1.05]

Hill, H. & Dodsworth, E. *Food inspection notes*. 2nd ed. 1947. Lewis, 6s. [£0.3]

Houghton, M. *Aids to practical nursing*. 5th ed. 1947. Baillière, 5s. [£0.25]

Illingworth, C. F. W., editor. *Textbook of surgical treatment including operative surgery*. 3rd ed. 1947. Livingstone, £1 12s. 6d. [£1.625]

Jellinek, S. *Dying, apparent-death and resuscitation*. 1947. Baillière, 10s. 6d. [£0.525]

Jones, W. H. S. *The medical writings of Anonymus Londinensis*. 1947. Cambridge University Press, 12s. 6d. [£0.625]

Jorpes, J. E. *Heparin in the treatment of thrombosis. An account of its chemistry, physiology and application in medicine*. 2nd ed. 1946. Geoffrey Cumberlege, Oxford University Press, 18s. [£0.9]

Klueva, N. G. & Roskin, G. I. *Biotoropiya zlokhachestvennikh opoekhoiyo*. 1946. Akademiya Meditsinskii Nauk SSSR (Moskva)

Kolff, W. J. *New ways of treating uraemia. The artificial kidney, peritoneal lavage, intestinal lavage*. 1947. Churchill, 10s. 6d. [£0.525]

Le Maistre, E. H. *Physical education*. 1945. Oxford University Press (Melbourne), 11s. 6d. [£0.575]

Lewis, H. K. & Co. Ltd. *Supplement to the catalogue of Lewis's medical, scientific and technical lending library: including a classified index of subjects with the names of those authors who have treated upon them. Supplement, 1944-1946*. 1947. Lewis, 5s. [£0.25] (To subscribers to the library, 2s. 6d.)

Lister Institute of Preventive Medicine. *Report of the governing body*. 1947. 1947. The Lister Institute of Preventive Medicine.

Low, R. C. & Dodds, T. C. *Atlas of bacteriology*. 1947. Livingstone, £1 12s. 6d. [£1.625]

McLachlan, A. E. W. *Handbook of diagnosis and treatment of venereal diseases*. 3rd ed. 1947. Livingstone, 15s. [£0.75]

Meredith, W. J., editor. *Radium dosage. The Manchester system*. 1947. Livingstone, 15s. [£0.75]

Merz, P. *La chirurgie gastrique par voie thoracique*. 1947. Imprimerie "Papyrus" (Oullins)

Micks, R. H. *The essentials of materia medica, pharmacology and therapeutics*. 4th ed. 1947. Churchill, 18s. [£0.9]

Millin, T. *Retropubic urinary surgery*. 1947. Livingstone, £1 5s. [£1.25]

Minnitt, R. J. *Gas and air oncolysis*. 3rd ed. 1947. Baillière, 5s. [£0.25]

Monnier, J. *La pénicilline à la portée du praticien et son emploi dans le traitement des maladies vénériennes*. 1946. Baillière (Paris)

Moodie, W. *The doctor and the difficult adult*. 1947. Cassell, 15s. [£0.75]

National Association for the Prevention of Tuberculosis. *Annual Report, 1946-1947*. 1947. National Association for the Prevention of Tuberculosis.

National Radium Trust and Radium Commission. *Seventeenth annual reports of the National Radium Trust and Radium Commission, 1945-1946*. 1947. His Majesty's Stationery Office, 6d. [£0.025]



- Nicole, J. R. *Psychopathology: a survey of modern approaches*. 4th ed. 1946. Baillière, 15s. [£0.75]
- Niedermayer, F. *Was ist nun eigentlich der Krebs?* 3. Aufl. 1947. Franz Deuticke (Wien), sw. fr. 5
- Pascual, J. A. *Estudios sobre el pulmón colapsado, aportaciones clínicas, histopatológicas y experimentales*. 1947. Publicaciones del Patronato Nacional Antituberculoso (Madrid)
- Peru. Ministerio de Salud Pública y Asistencia Social, Dirección General de Salubridad. *La protección materno-infantil en los últimos cinco años, 1940-1944*. [n.d.] Servicio Nacional de Protección Materno-Infantil (Lima)
- Plesch, J. *Blood pressure and its disorders including angina pectoris*. 2nd ed. 1947. Baillière, £1 1s. [£1.05]
- Plesch, J. *János, the story of a doctor*. Translated by Edward Fitzgerald. 1947. Gollancz, 18s. [£0.9]
- Raper, H. R. *Man against pain: the epic of anaesthesia*. 1947. Gollancz, 10s. 6d. [£0.525]
- Rees, J. R., editor. *The ease of Rudolf Hess. A problem in diagnosis and forensic psychiatry*. 1947. Heinemann, 12s. 6d. [£0.625]
- Roxburgh, A. C. *Common skin diseases*. 8th ed. 1947. Lewis, £1 1s. [£1.05]
- Russell, C. S. *The childbearing years*. 1947. Blackwell, 7s. 6d. [£0.375]
- Scott, J. A. *The Notional Health Service Act, 1946. Together with an index to the Act compiled by H. A. C. Sturgess*. 1947. Eyre & Spottiswoode, 9s. 6d. [£0.475]
- Sherrington, C. S. *The integrative action of the nervous system*. 2nd ed. 1947. Cambridge University Press, £1 5s. [£1.25]
- Sippe, G. & Twining, M. *Survey and field treatment of malaria in Mauritius*. 1946. Published on behalf of the Government of Mauritius by the Crown Agents for the Colonies, £1 5s. [£1.25]
- Smillie, W. G. *Preventive medicine and public health*. 1946. Macmillan (New York), £1 10s. [£1.5]
- de Souza-Araujo, H. C. *Leprosy. Survey made in forty countries (1924-1927)*. 1929. Oswaldo Cruz Institute (Rio de Janeiro)
- Spain. Patronato Nacional Antituberculoso. *La lucha antituberculosa en España*. [1947.] Publicaciones del Patronato Nacional Antituberculoso (Madrid)
- Stephanides, T. *The microscope and the practical principles of observation*. 1947. Faber, 10s. 6d. [£0.525]
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- Suomen Punainen Risti. *Ja sen lastensuojeluosasto Kenraali Mannerheimin lastensuojeluliitto: Toimintakertomus* 1946. 1947. Tilgmannin Kirjapaino (Helsinki)
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- Thorpe, W. V. *Biochemistry for medical students*. 4th ed. 1947. Churchill, 18s. [£0.9]
- Tidy, H. L., editor. *Inter-allied conferences on war medicine 1942-1945: convened by the Royal Society of Medicine*. 1947. Staples Press, £2 10s. [£2.5]
- Tidy, N. M. *Massage and remedial exercises in medical and surgical conditions*. 7th ed. 1947. Wright, £1 5s. [£1.25]
- Treves, F. *The student's handbook of surgical operations*. 8th ed. revised by C. P. G. Wakeley. 1946. Cassell, 15s. [£0.75]
- Truax, R. *Joseph Lister: father of modern surgery*. 1947. Harrap, 10s. 6d. [£0.525]
- Trueta, J. et al. *Studies of the renal circulation*. 1947. Blackwell, £1 5s. [£1.25]
- Viñes Ibarrola, J. *Una epidemia de peste bubónica en el siglo XVI. Variaciones sobre la epidemiología y profilaxis de la peste, según testimonios inéditos de médicos españoles de la época*. 1947. Editorial Aramburu (Pamplona)
- Wakeley, C. P. G., editor. *Modern treatment year book* 1947. 1947. The Medical Press, 15s. [£0.75]
- Walker, N. & Percival, G. H. *An introduction to dermatology*. 11th ed. by G. H. Percival. 1947. Livingstone, £1 15s. [£1.75]
- War Office. *Memoranda on medical diseases in tropical and sub-tropical areas*. 8th ed. 1946. His Majesty's Stationery Office, 7s. 6d. [£0.375]
- Weber, F. P. *Rare diseases and some debatable subjects*. 2nd ed. 1947. Staples Press, 15s. [£0.75]
- Widdowson, E. M. *A study of individual children's diets*. (Medical Research Council. Special Report Series No. 257.) 1947. His Majesty's Stationery Office, 6s. [£0.3]
- Willenegger, H. & Boitel, R. *Der Blutspender*. 1947. Schwabe (Basel), sw. fr. 10
- Williamson, G. S. & Pearce, L. H., editors. *Biologists in search of material: an interim report on the work of the Pioneer Health Centre, Peckham*. 1947. Faber, 5s. [£0.25]
- Wilson, N. *Municipal health services*. 1946. Allen & Unwin, 7s. 6d. [£0.375]
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## Introduction

There has recently been published an account of the six public lectures delivered to the XI International Congress of Pure and Applied Chemistry which was held in London last year. From this account it is seen that four of the six lectures were clearly of biochemical substance, while the fifth, that delivered to the section of Organic Chemistry, was largely devoted to natural materials of the liveliest concern to biochemists. Since the Congress was concerned with chemistry in the widest sense of the word, the devotion of such a large proportion of interest to matters of biological import once again emphasizes the immense influence which biochemistry is exerting upon the primary sciences.

It is good that the emphasis on the "chemistry" in "biochemistry" should be sounded, but such an emphasis carries with it two potential dangers. First, the attractiveness of those investigations which are devoted to the chemistry of substances of biological significance may detract seriously from the fundamental work on chemistry for its own sake, work upon which future developments inevitably rest. For example, progress in the development of methods for the synthesis of penicillin are impeded by the paucity of fundamental knowledge concerning the chemistry of four-membered rings containing a nitrogen atom. It is of the greatest importance to biochemistry and to medicine that chemists should never cease to explore the

reactions and properties of purely synthetic substances, even though such substances have apparently no connexion with biology or with medicine.

The second danger is more subtle but nevertheless just as real. It is of the highest importance that the spectacular results which have already been achieved by a purely chemical attack upon biological materials should not divert the attention of biochemists from the core of the problem of biochemistry—the study of the enzyme system within the cell. Although chemistry and biochemistry must necessarily overlap to a substantial extent, the chemist is primarily interested in the fragmentation and synthesis of molecules in the laboratory, while the biochemist should be, and is, more fundamentally concerned with the changes which substances undergo within a living system, both in the building up of such a system, and in the maintenance of it by metabolic processes.

In this country the dynamic approach to biochemical problems was largely founded by the investigations and ideas of the late Sir Frederick Gowland Hopkins, whose famous dictum, "Life is the expression of a particular dynamic equilibrium which obtains in a polyphasic system", is quoted in the article, *Biochemical Integration in Cellular Function*, by Dr. Ernest Baldwin, a pupil of Gowland Hopkins, which appears in the present issue. It is therefore not inappropriate that this issue of the *British Medical Bulletin* should be regarded as a tribute to the work and memory of Sir Frederick Gowland Hopkins. The article on Gowland Hopkins by Joseph and Dorothy Needham has been written from a personal point of view which, it may be hoped, will assist many who did not know Hopkins to appreciate something of the charm and inspiration which he shed upon those around him. It is fitting, too, that the ideas and teaching of Hopkins and his school should recently have been ably summarized in a textbook by Ernest Baldwin entitled *Dynamic aspects of biochemistry* (Cambridge University Press, 1947), a book which will almost certainly inspire the teaching of the subject for many years to come.

It is one of the triumphs of biochemistry that it provides a potent integrating force in medicine which, until the present time, had been completely lacking. For instance, the integration of such diverse branches of medicine as bacteriology and nutrition on a biochemical

basis is now so widely accepted that the articles on *Metabolic Processes in Micro-Organisms* by Drs. Marjory Stephenson & Ernest Frederick Gale, and *Wider Aspects of Studies of the Nutrition of Micro-Organisms* by Dr. D. D. Woods naturally fall within their places in the present volume. Again, *The Development of British Anti-Lewisite (BAL)* by Prof. Peters and his colleagues at Oxford provides an excellent example of the value of the biochemical approach to an apparently complex pathological problem, with the enzyme system as the focus of attack. Findings of the greatest theoretical and practical significance, which are ably discussed by Prof. Peters, have accrued from this work, while his collaborator, Prof. R. H. S. Thompson, deals with the *Therapeutic Applications of British Anti-Lewisite* which have subsequently been developed upon general lines. The fact that biochemistry can provide a rational treatment for the toxic conditions due to arsenic, gold and other metals, is but one of the many vindications of the theoretical approach followed by Peters and his school.

The work of Beadle, Tatum and others, on the nutritional requirements of x-ray-induced mutants of *Neurospora crassa* and other organisms, has provided a previously unexpected line of attack upon the problems of the biochemistry of intermediary metabolism, but the implications of this work are very wide, and are only now being realized. Their application to human genetics is still to be developed, but in his article on *Human Biochemical Genetics*, Mr. Tracey recalls the pioneer work of Garrod and others upon inborn errors of metabolism, the study of which has received a new impetus from the recent experimental investigations on micro-organisms.

The article by Mr. N. W. Pirie entitled *Development of Ideas on the Nature of Viruses* deals in a critical manner with some of the speculative ideas which have abounded since the pioneer work of Stanley and his colleagues on the so-called crystallization of plant viruses. But such criticisms need not detract from the significance of the results of this purely biochemical attack upon a problem which was originally one confined to pathologists or bacteriologists. The problems of immunology have provided the material for the irruption of biochemistry into another field not previously

explored from such an angle, and this aspect of the work is ably discussed by Prof. A. Wormall in his article *Contributions of Chemistry to the Problems of Immunology*. The articles on Fibrous Proteins as Components of Biological Systems and on Some Newer Knowledge of Plasma Proteins, by Dr. Kenneth Bailey and Dr. R. A. Kekwick respectively, describe work which is mainly directed towards the problem of the identity and nature of the building-stones of biological systems, while *Amino-Acids in Nutrition* by Dr. A. Neuberger brings us back once more to the dynamic aspects of biological equilibria.

The articles in the present number of the *British Medical Bulletin* illustrate the significance of the progress in medical science towards the study of smaller and smaller units. In the early days the organ was the element for study, but the work of Bichat on the fundamental concept of tissues and later the investigations of Virchow elaborated the idea of the cell as the essential unit in all tissues and organs. Modern biochemistry has developed this idea still further, and now regards the underlying fundamental unit as the molecule. It is from this idea that the unifying influence of bio-

chemistry upon the diverse phenomena of biology and medicine springs. Whatever their origin, cells are found to have certain elements of structure in common. They all contain proteins, fats and carbohydrates. Their metabolic processes are catalyzed by enzymes which are surprisingly similar in nature and function wherever they may be found throughout the species. Enzymes co-operate with co-enzymes, which again are widespread to a surprising degree. Co-enzymes in many instances are constructed from essential constituents of the food, hitherto known as vitamins when human or animal nutrition is under consideration. That many micro-organisms nutritionally depend upon a supply of such vitamins has been a discovery of great practical and theoretical significance.

By thus revealing a common ground-plan among so many different biological systems, the biochemist has provided an understanding to the solution of many medical problems, the approach to which could previously be only empirical. To such developments the biologist and the medical man, no less than the biochemist, owe an immense debt to the intuitive insight of Frederick Gowland Hopkins.

F. G. Young

THE EDITOR wishes to acknowledge the valuable help given by Professor F. G. Young of the Department of Biochemistry, University College, London, in the planning of the Symposium of this number and for writing the Introduction.

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We would also like to draw the attention of our readers, especially of those abroad, to the article by Dr. F. H. K. Green which appears at the beginning of Part II of this number (page 352), on the origin, constitution and functions of the Medical Research Council. During the war Dr. Green was secretary of the MRC War Wounds Committee and of the Therapeutic Trials Committee and is now Assistant Secretary to the Council. This authoritative article, with its useful table showing the principal research establishments of the MRC, should prove of great value to those interested in medical research in Great Britain.





*Ramsay & Muspratt, Cambridge*

SIR F. GOWLAND HOPKINS

1861-1947

1194

## SIR FREDERICK GOWLAND HOPKINS O.M. P.R.S.

JOSEPH AND DOROTHY NEEDHAM

In writing something on "Hoppy" (as he was universally known in the world of biochemists) by way of introduction to this special number of the *British Medical Bulletin*, it will be our aim to try to give some impression, however faint, of his personality, supplementing the accounts of his life and work which have already appeared.<sup>1</sup> Our excuse may be that for more than twenty-five years he stood *in loco parentis* to us, as to all other Cambridge biochemists of our generation.

It is therefore not necessary to repeat in great detail the story of his life and principal investigations—his early work in a toxicological laboratory, his medical training at Guy's Hospital, his invitation to Cambridge in 1898 by Sir Michael Foster, the tutorship at Emmanuel, the praelectorship at Trinity, a chair in 1914, a great new building in 1925, the Order of Merit, the Nobel Prize, and so on. Widely known, too, is the course of his researches; first on gout and uric acid and the pigments of butterflies, then on amino-acids with the discovery of tryptophan (with Cole), then on the accessory food-factors now called vitamins, next to muscle-contraction and lactic acid (with Fletcher); and finally to oxydo-reductions and the discovery of glutathione—a subject which kept his interest during most of the period between the two World Wars—until at the end he returned with more precise analysis to his earliest interest, the pterine pigments of lepidoptera, now with much wider physiological significance.

The first twenty years of Hopkins' work and teaching were carried out in an extremely old and uncomfortable building in Corn Exchange Street, many of the rooms of which were semi-cellars. We can well remember this, as it lasted in partial use until the construction of the present Institute in Tennis Court Road in 1924. Much of the equipment was antique, too; for example, a centrifuge which was mounted on boards and had no arrangements for securing it to a base, used to ride all over the floor of a cellar when in operation. It was in these rooms that the rat-colony was kept; its entire feeding and upkeep during the classical investigations on vitamins in 1910 were done by Hopkins himself. Upstairs was the shelf on which had stood in the sunlight the bottle of acetic acid which had led to the discovery of the glyoxylic test for tryptophan. Below were the ancient benches on which "Charles" had cut up the quarters of horses towards the end of World War I for the extraction of glutathione.

The year 1920 saw expansion into a building hardly less

queer than that in Corn Exchange Street, namely an old chapel in Downing Place where the space level with the galleries had been specially floored. A bridge connected the main part with an annexe in which Hopkins himself worked. Here developed all the lines of research which were afterwards to characterize Hopkins' institute—intermediary metabolism, especially that of sulphur compounds; bacterial metabolism; the chemistry of muscular contraction; the precise physico-chemical study of enzymes and pigments; and embryological and zoological biochemistry.

By no means the least important of the rooms in this building was the library (Hopkins was always ready to die in the last ditch for the departmental-library principle) and tea-room. Throughout the fifty years of Hopkins' work at Cambridge there were held weekly or fortnightly tea-club meetings, at which one or other of the research-workers would give an account of work in progress or nearing completion. The standard of criticism at these meetings was extremely severe, so that the speaker met with more rational and constructive comment there than he was ever likely to encounter at subsequent meetings of public societies to which he might communicate his work. It was at these meetings that Hopkins' genius particularly showed itself; he invariably made every paper seem interesting, what the author might have dully presented he illuminated with a flow of historical allusions and valuable suggestions springing from his profound intuitive insight into the structure and functions of the living cell. No one could speak or act as if blinded by passion or prejudice when in the presence of a leader so objective yet so encouraging, so affectionate yet so penetratingly quizzical, whose insight was conveyed by hints and odd remarks to which no one could object, but which one disregarded at one's peril.

Perhaps these meetings were so searchingly critical precisely because of "Hoppy's" own extraordinary charm and kindness. Under his aegis almost anything could be said without fear of offence. This was, in fact, his most outstanding personal quality; he was a living embodiment of the Confucian maxim that one should behave to everybody as one receiving a great guest. The humblest laboratory assistant or the youngest research worker was always sure of a welcome, and a hearing, unhurried and attentive, much longer than he was likely to get from any other scientific man of the same standing or generation. Hopkins had faith in people. Colleagues were known to remark lightly that "All Hoppy's geese are swans", but they forgot that there is an induction process by which certain geese may be turned into swans if given the hormone of encouragement.

It was undoubtedly for these reasons that when we attempted recently to recapture some characteristic sayings of Hopkins, some "famous remarks" of Johnsonian flavour, we found it quite impossible to do so. This fact is of interest in itself. He was too courteous, in a way too self-effacing, to allow himself to be the author of epigrams which might hurt anyone; he expressed himself so diffidently, and above all he spent so much of his time listening to other people, that his essence cannot be treasured in a few *bons mots*. He was a great giver and receiver of moral support—if he gave freely of it to all his collaborators and colleagues, he also needed it, for he frequently passed through periods of depression. And this was one of his

<sup>1</sup> E.g.—*Brit. med. J.* 1947, 1, 742  
*Lancet*, 1947, 1, 728  
*Nature, Lond.* 1947, 160, 44

secrets, that he was open to receive it from the most junior of his research workers, so that they did not feel he was encouraging them like some *deus ex machina*, but as one of themselves; in other words he fully understood and practised the great doctrine of leadership *from within* and not from above.

Anyone who obtained the impression from what has been said that Hopkins had a colourless personality would indeed be wide of the mark. He did not say things that make the stuff of anecdotes, he did not speak much on the radio or appear prominently in the public press, he did not engage in polemics. But he had the knack of surrounding himself with people of striking personality, such as A. Szent-Györgyi (the Hungarian Nobel Prize winner and discoverer of the chemical constitution of vitamin C), J. B. S. Haldane (afterwards Professor of Genetics at London), Marjory Stephenson (one of the first women to become F.R.S.), T. S. Hele (later Master of Emmanuel and Vice-Chancellor of the University), etc., etc. But nothing ever put "Hoppy" in the shade. No one could fail to recognize in the little figure, rubbing its eyes in a characteristic gesture during a conference, loitering with overcoat unbuttoned in the hall, or proceeding with ruminative walk past the colleges, the authentic gold of intellectual inspiration, the *Fundator et Primus Abbas* of biochemistry in England.

The pattern completes itself when we look at the various practices which he established. Contrary to what has been known in some English and many continental laboratories, Hopkins would never put his name to any scientific paper for which he had not himself done a considerable part of the manual and experimental work involved. Although no doubt great results are to be achieved by the direction of large teams, he was never interested in forcing the diverse talents of his younger colleagues into the funnel of one problem, as he could well have done in such matters as vitamins or oxydo-reductions. On the contrary, he was always looking out for originality, and encouraged the smallest sprouts of it to develop in their own way. Sometimes a young worker would devote himself to some subject which "the Professor" had initiated and then dropped, and make a life-work of it—this happened with vitamins, with muscle-biochemistry, and with oxidation-reduction enzymes. In other cases, a young worker would start something new with every possible encouragement from Hopkins—this happened with the metabolic chemistry of micro-organisms, with embryological biochemistry, and with the study of plant-pigments. One of us certainly will never forget how quickly Hopkins appreciated the fascination of the hen's egg as a closed-box system of chemical transformations; he said that there were many lifetimes of work in it, and it put him in mind of a discussion he had had at Michael Foster's breakfast-table some twenty years earlier.

If, then, Hopkins' outstanding personal characteristic was a universal courtesy, even a capacity to suffer fools gladly (knowing that some fools may change into wise men in the process), what was his outstanding intellectual characteristic? Originally, we believe, it was a deep intuitive faith in the explicability of the biochemistry of the living cell—the same faith which once inspired Aristotle when, in the face of the apparently infinite complexity of living forms, he nevertheless maintained that it was possible to classify them, and proceeded to do so in at least a pre-

liminary way. Having in mind what we know now about the numbers of species of arthropods, and how little we yet know about the physiology of invertebrates in general, Aristotle's faith seems indeed extraordinary. Hopkins was of the same lineage, for at a time when it could be said, or had until shortly before been currently said, "*Tierchemie ist nur Schmierchemie*", he knew better. He was not only an organic chemist who could isolate substances from living tissues and study their chemical structure; he was a *biochemist* who could in imagination perform the synthetic process of building back the living cell and of visualizing what processes were going on in it. And this was all the more extraordinary in that he was himself not the direct pupil of any of the pioneers of biochemistry. Here came into play his intuition. At a relatively late period one of the more provocative of the younger research workers opined that "Hoppy" was not a great experimentalist, and on being asked why, replied that it was because he did not need to do experiments, he knew which way the cat would jump beforehand, and only needed to carry out practical work to demonstrate what his insight had already told him was true. This was not at all an unfair judgement, though paradoxical in that Hopkins was in fact a brilliant practical chemical manipulator and experimentalist; a most accomplished laboratory worker. By 1914 Hopkins had transmuted the old German jibe into the famous definition: "Life is a dynamic equilibrium in a polyphasic system."

As to scientific literature, Hopkins was by no means a despiser of it, as some eminent experimentalists have been, trusting in their own originality and in the mistakes of others. He read a great deal, and often inspired his listeners with enthusiasm for neglected pioneers such as Thudichum, the investigator of the brain lipids; or de Rey Pailhade, the discoverer of "phylthione", the hypothetical substance which preceded the real glutathione. In later stages, the walls of the laboratory were decorated with engravings of Lavoisier, Harvey, Boyle, Hales, Scheele, etc., together with an original manuscript of Liebig. Hopkins' lectures to the advanced class were often largely historical. One characteristic which all his pupils remember was his trick of waving about in a beaker of water the feather of a tropical bird, from which the water-soluble pigment turacin comes out—anyone who was not interested in such a phenomenon would, he used to say, never make a biochemist. It was equally characteristic of him that when, on one occasion, one of the more phlegmatic young research-workers was not perceptibly excited by it, he remarked that of course one must in this test make allowances for temperament. At the very close of his life, when he was perhaps remembering more of his youth, he told another pterine investigator that as a boy he had taken the wings of a butterfly and heated them in a spoon on the kitchen range of his home; when the pigments dissolved in the water he was extremely astonished and delighted.

So far as we can remember Hopkins had no particular hobby except reading, which he did largely in a fairly unselective way, on all kinds of subjects, such as history, archaeology and the like. One of his daughters was destined to become a distinguished archaeologist, doubtless not without some encouragement from these broad interests of her father's. Though he never visited any of the remoter parts of the world, he always took a great interest in people

*Continued at foot of page 301*

## BIOCHEMICAL INTEGRATION IN CELLULAR FUNCTION

ERNEST BALDWIN B.A. Ph.D.

*Biochemical Laboratory, Cambridge*

- 1 Intracellular dynamics
- 2 Source of muscular energy
  - a Phosphorylation
  - b Glycolysis
  - c Oxidation
- 3 Extramuscular energy

"La vie," declared Lavoisier in 1780, "est une fonction chimique". Liebig, echoing Lavoisier's belief, in an address to the Chemical Section of the British Association in 1837, expressed his conviction that in the newly-founded science of organic chemistry, biology could find its most powerful ally. But the cry of the chemists that "Tierchemie ist Schmierchemie", and the obscurantist tactics of many biologists, delayed the large-scale application of chemical methods to biological problems for more than 50 years. A few, notably Voit and his pupil Rubner, followed in Liebig's footsteps and, in 1894, Rubner could announce his calorimetric demonstration that the amount of energy expended

by a living organism is exactly equivalent to the energy set free by metabolism within the body; that living, like non-living systems, conform to the principle of the conservation of energy.

### 1. Intracellular Dynamics

For the early development of its dynamic side, biochemistry owes its greatest debt to Gowland Hopkins, whose recent death has deprived us of the subject's most powerful protagonist and its most inspired and inspiring leader. Of his many speeches and addresses perhaps none was more significant or far-sighted than that delivered to the Physiological Section of the British Association in 1913. Setting aside the "vital forces" as an unnecessary postulate, he pointed out with incisive clarity the greatness of the part the organic chemist could play in the development of biochemistry. "One reason", he said,

which has led the organic chemist to avert his mind from the problems of Biochemistry is an obsession that the really significant happenings in the animal body are concerned in the main with substances of such high molecular weight and consequent vagueness of molecular structure as to make their reactions impossible of study by his available and accurate methods . . . So far from this being the case, recent progress points in the clearest way to the fact that the molecules with which a most important and significant part of the chemical dynamics is concerned are of a comparatively simple character.

Later in the same address came what is perhaps Hopkins' most celebrated utterance:

On ultimate analysis, we can hardly speak at all of living matter in the cell; or at any rate we cannot, without gross misuse of terms, speak of the cell life as being associated with any one particular type of molecule. Its life is the expression of a particular dynamic equilibrium which obtains in a polyphasic system . . . but "life", as we instinctively define it, is a property of the cell as a whole, because it depends upon the organisation of processes, upon the equilibrium displayed by the totality of the co-existing phases.

### FREDERICK GOWLAND HOPKINS

*Continued from page 300*

who came from them and welcomed them to his laboratory, which thus acquired and maintained throughout a thoroughly international character. Before the first World War he had a number of Japanese pupils, but later only one—an odd character who caused some confusion in the laboratory by coming in late at night to work (it was typical of the institute that it was always available for work all night) and hanging his coat and hat on the thermostat-rod of an incubator. China and India were represented and North and South America very much so, while all the countries of Europe and the Near East contributed at one time or another their quota of investigators, as did all the Dominions of the British Commonwealth. Frequently a postcard would arrive filled with signatures from bodies such as the "Hoppy Club of San Francisco". Correspondingly, the presentation volume *Perspectives in biochemistry* which he received upon the occasion of his 75th birthday, was a success altogether unexpected by its publishers, the Cambridge University Press, and went into three editions.

From what has already been said, it will be obvious that Hopkins was naturally a democrat. We shall always remember a meeting, held in 1942, which was designed to inform all those working in the institute, including especially the laboratory assistants and cleaners, in semi-popular language, of what exactly were the various pieces of war research being carried out in the institute. Each speaker was given only three minutes. It was expected and understood that the Professor, in view of his age

and eminence, would take longer; but no, the Nobel Prizewinner and ex-President of the Royal Society said his say in exactly the same time as all the others. The meeting achieved its purpose of intensifying the war effort of the institute.

A perfectly sympathetic personality is not usually achieved without cost. There is no doubt that Hopkins had a very severe struggle in his early years, and at the end of his Emmanuel tutorship he was so overworked that he suffered a kind of nervous breakdown for a short time. Daily, hourly, as everyone must with something new to give to the world, he battled with the philistines. Unfortunately, in his very last years he also had much to suffer, when increasing physical disabilities coexisted with undiminished retention of intellectual power and curiosity. But it all resulted in a personality which drew from his colleagues not only intellectual admiration but deep affection and even veneration. So many of the Taoist paradoxes were found to be applicable to Hopkins—"The Sage follows after things, in order that he may control them"—"The Sage has no personal wishes, therefore all his desires are fulfilled". Inspired by his intuitive understanding of the living cell, Hopkins stood self-forgetful in front of the facts. One can see him now, at the top of the stairs, coat open and hands in pockets, backed by his technical assistant, with cigarette drooping over the centrifuge tubes; head quizzically slightly at an angle, benignly smiling, enquiring about the latest results. One never came across anybody at all like him, and now one is sure one never will.

This insistence upon the essentially dynamic nature of intracellular affairs has led in our own time to a new knowledge and understanding of metabolism in relation to physiological function, and in the cells of muscle above all other tissues we are beginning to see a closely integrated picture of the association between chemical composition, intermediary metabolism, and cellular function. In this article an attempt is made to show how, upon the foundations laid by Hopkins himself, our present knowledge has been built.

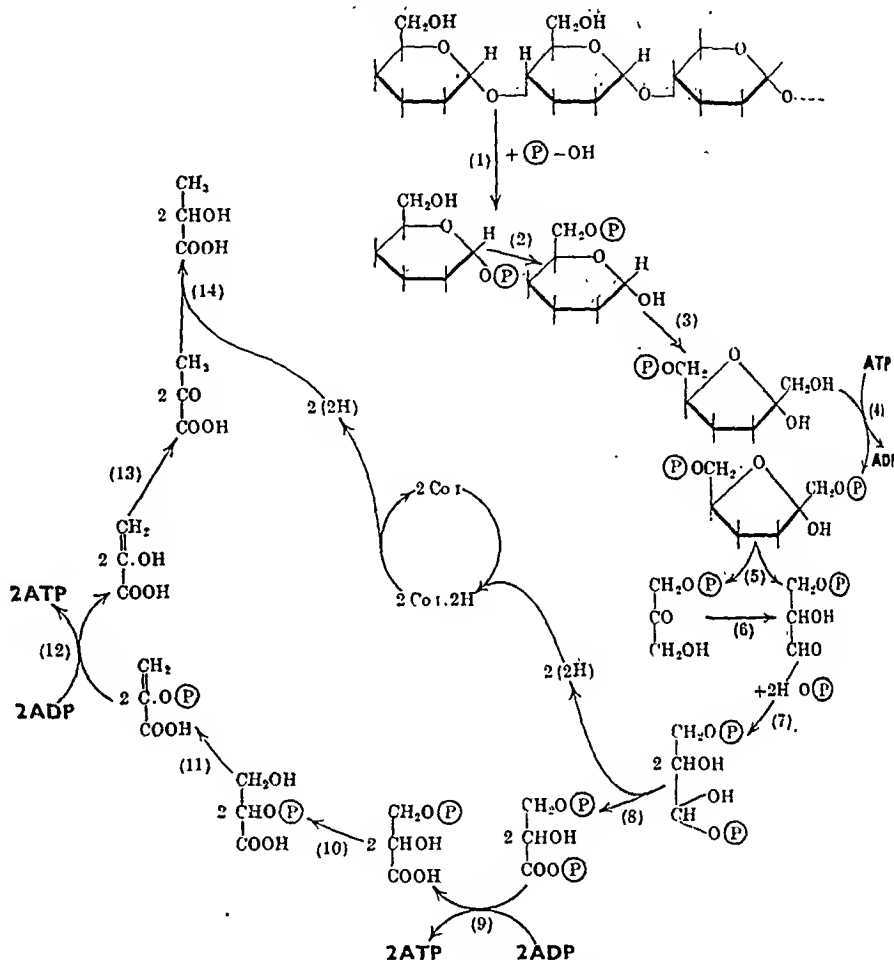
## 2. Source of Muscular Energy

Already, in collaboration with Fletcher, Hopkins had provided a starting-point by supplying the first unequivocal evidence that, under anaerobic conditions, muscular activity is associated with the formation of lactic acid. This pioneer work was soon followed by demonstrations from other laboratories of quantitative relationships between work done, heat or tension developed in muscle, and the amounts of glycogen disappearing and lactic acid formed. That glycolysis furnishes the ultimate source of contraction-energy was established beyond doubt. Later, however, Lundsgaard discovered that a muscle, previously poisoned with iodoacetate, is capable of normal contraction without the formation of any lactic acid whatsoever. Iodoacetate prevents glycolysis completely, but does not interfere with the decomposition of phosphagen (creatine phosphate), a normal muscle-constituent discovered about three years earlier by the Eggletons in Britain and by Fiske & Subbarow in the USA. Quantitative relationships between work done and the amount of phosphagen decomposed in iodoacetate-poisoned muscle were next established and, since such a muscle goes into rigor as soon as its supplies of phosphagen are exhausted, it appeared that the hydrolysis of phosphagen is a more-immediate source of contraction-energy than glycolysis itself.

A new mine was sprung when Lohmann showed conclusively that, if phosphagen is added to a dialyzed muscle-extract, it fails to undergo hydrolysis. If adenylic acid is added to the extract, phosphagen breaks down, but not by hydrolysis as had been anticipated. Instead, its phosphate radical is transferred to the adenylic acid, with formation of free creatine and adenosine triphosphate (ATP). Now resting muscle contains ATP but no adenylic acid. It therefore follows that ATP must be decomposed before any breakdown of phosphagen can take place, so that yet another process is interposed between glycolysis, which is the ultimate energy-source, and contraction itself. Englehardt & Lubimowa subsequently discovered that the enzyme catalyzing the decomposition of ATP is identical with the contractile protein of the muscle, myosin, and thus established

a close logical connexion between the contractile material of the cell, the enzyme that liberates the contraction-energy, and the immediate source of that energy. In passing, it should be noticed that myosin catalyzes the removal of only one of the three phosphate-radicals of adenosine triphosphate,

FIG. 1. SCHEME TO ILLUSTRATE THE REACTIONS INVOLVED IN GLYCOLYSIS\*



The part played by phosphagen is omitted for the sake of clarity. The enzymes and coenzymes involved are listed in Table I.

TABLE I. GLYCOLYSIS: ENZYMES, COENZYMES AND INHIBITORS\* (see also fig. 1)

Reaction	Enzyme	Coenzyme
1	Phosphorylase	$-\text{PO}_3\text{H}_2$
2	Phosphoglucumutase	—
3	Oxoisomerase	—
4	Phosphohexokinase	ATP
5	Zymohehexase	—
6	Phosphotriose isomerase	—
7	? Spontaneous	$-\text{PO}_3\text{H}_2$
8	Triosephosphate dehydrogenase	Coenzyme I
9	Unnamed phosphokinase	ADP
10	Phosphoglyceromutase	—
11	Enolase	Mg ions
12	Unnamed phosphokinase	ADP
13	? Spontaneous	—
14	Lactic dehydrogenase	Coenzyme I

\* Reprinted from Baldwin, "Dynamic aspects of biochemistry", fig. 28, table 26, by kind permission of the Cambridge University Press.

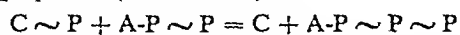


so that the product is not adenylic acid (adenosine monophosphate) but the corresponding adenosine diphosphate (ADP). This compound, like adenylic acid itself, can be phosphorylated by reaction with phosphagen.

"... The energy of the muscle", said Hopkins in the address already quoted, "is continuously supplied by the progress of organic reactions, and for a full understanding of events we need to know every detail of their course". As far as anaerobic events are concerned, such a knowledge has been gradually accumulated by the work of many investigators, notably by Meyerhof, Parnas and D. M. Needham, and we are now able to give what we believe to be a fairly complete account of the reactions leading from glycogen to lactic acid in the muscle. The reaction-sequence as we now believe it to take place is summarized in fig. 1. It involves some dozen enzymes and half-a-dozen or more coenzymes. We may well exclaim with Hopkins, "What indeed are we to think of a chemical system in which so great an array of distinct catalysing agents is present, or potentially present?" But, "Underlying the extreme complexity we may discover a simplicity which now escapes us." Hopkins' intuition here, as in so many cases, has been amply justified, this time by the discovery that the molecules of adenosine triphosphate and certain other compounds of phosphoric acid possess some very peculiar properties.

#### *a. Phosphorylation*

The ATP molecule can be visualized as consisting of a molecule of adenosine to which are attached in series three phosphate radicals. If the terminal phosphate radical is removed by hydrolysis there is an output of heat amounting to some 12,000 calories for each gram-molecule of phosphate removed. A similarly high yield of energy is obtained if the second linkage is ruptured, but the removal of the last phosphate radical is attended by a comparatively trivial thermal change, amounting in this case to only about 2,000 calories per gram-molecule. Lipmann therefore speaks of the first two phosphate linkages as "energy-rich bonds", as contrasted with the third, an "energy-poor bond", which is typical of phosphate-ester bonds in general. Still more important was the discovery, due in the first instance to Lohmann, that these "energy-rich" phosphate radicals can, under certain conditions, be transferred from one molecule to another, without the loss of any energy whatsoever. Thus, in the presence of the muscle enzymes, phosphagen, which also contains an energy-rich phosphate-bond, can transfer its phosphate radical, together with the energy with which it is associated, to a molecule of ADP so that a new molecule of ATP is produced. Representing the phosphate radical by P and the energy-rich bonds by the special symbol  $\sim$ , this process can be represented by the following equation (C = creatine):



Picture now the events following upon the arrival of a stimulus in an iodoacetate-poisoned muscle-cell. In some manner of which we are still ignorant, the muscle myosin gains access to and acts upon ATP, its molecules shortening as it does so, so that the energy of the terminal energy-rich phosphate bonds of the ATP molecules appears largely in the form of mechanical work. The products of the reaction are ADP and free, inorganic phosphate. As fast as ADP is produced it is re-phosphorylated and re-energized at the

expense of phosphagen, and this process of alternate decomposition and reconstitution of ATP continues until activity ceases or the phosphagen supplies are exhausted, in which case the muscle goes into rigor. The amount of stored energy-rich phosphate present in the form of phosphagen is four or five times greater than that initially available in the form of ATP, so that phosphagen must clearly be regarded as a device which allows the cell to remain in full activity until glycolysis, which of course takes place in the normal unpoisoned muscle, gets under way. Glycolysis, indeed, is known to be relatively slow in getting started although, once established, it can resynthesize ATP from ADP as fast as, or faster than the reaction with phosphagen. Apart from a few other types, such as the electric cells of certain fishes, only the cells of muscle are normally called upon for sudden response in the form of a very high rate of energy-output, and in all such cells we find that smaller or larger stores of phosphagen are present. Other cells, such as those of yeast and liver, which are characterized by more leisurely forms of activity, use essentially the same glycolytic mechanisms, but contain no phosphagen, and the latter must therefore be regarded as a specialized, adaptive mechanism that tides the muscle-cell over the interval between the onset of activity and the full establishment of glycolysis, an adaptation without which the sustained high level of energy-output so characteristic of muscle could not be achieved.

#### *b. Glycolysis*

What now of the glycolytic processes? Examination of fig. 1 shows that for each 6-carbon unit of glycogen broken down to lactic acid, 3 new molecules of ATP are formed from ADP. The synthesis of ATP from a compound of lower energy-content calls for the provision of energy. The chemist, faced with the task of achieving an energy-consuming synthesis, resorts to the use of high temperatures, strong acids, alkalis and other powerful reagents, resources that are denied to the living cell. It follows, therefore, that the reactions immediately preceding the formation of new molecules of ATP must be of fundamental biochemical significance. One of these reactions (reaction 8) consists in a simple dehydrogenation and the second (reaction 11) in a dehydration. The products of these reactions, unlike their precursors, contain energy-rich phosphate bonds, and it is by the transference of these to ADP that the new molecules of ATP are formed. The energy which becomes as it were "concentrated" in the newly-formed energy-rich bonds arises, of course, from the intrinsic chemical energy of the precursors, becoming "concentrated" in the energy-rich bonds as a result of the intramolecular rearrangements catalyzed by the muscle enzymes. Thus, through the reactions of glycolysis, the chemical energy of the stored glycogen of the cell is made available for transfer to ATP, the immediate energy-source of muscular contraction. There is, then, an unexpected simplicity behind the agglomeration of reactions that makes up the glycolytic process, which now appears essentially as a mechanism for the generation of new energy-rich bonds which, by transference to the ADP-ATP system, can be put to physiological service by the cell.

How nicely the metabolism is integrated with the functional needs of the cell can be appreciated from the following considerations. The first energy-significant reaction taking place on the arrival of a stimulus at the muscle-cell consists

in the disruption of ATP by the muscle myosin, the products of the reaction being ADP and inorganic phosphate. The former is promptly re-phosphorylated at the expense of phosphagen, leaving free inorganic phosphate in the milieu. Now, as fig. 1 shows, inorganic phosphate is an indispensable reactant at two points in the glycolytic reaction-chain, viz. at reactions 1 and 7. Glycolysis cannot therefore proceed unless free phosphate is available, but when the cell enters into activity and free phosphate becomes available, glycolysis begins and continues as long as any free phosphate remains. Once activity has commenced, therefore, glycolysis continues and, even when activity has ceased, still continues for a short period, until all the available phosphate has been removed, the normal resting level of ATP has been restored, and the resting stores of phosphagen replenished (see also table I).

### c. Oxidation

So far we have considered muscle only under anaerobic conditions. In the more normal state of virtually complete aerobiosis no lactic acid is produced; its immediate precursor, pyruvic acid, is completely oxidized to carbon dioxide and water, instead of being reduced. Our present knowledge of the oxidative processes is far less complete than that of the earlier anaerobic phase, but certain facts have nevertheless been established. Many of the intermediate reactions are known and it has been established that oxidation, like glycolysis, is associated with the generation of new energy-rich bonds and their transference to ADP. Recent estimates put the yield at about 40 to 50 such bonds for each 6-carbon unit of glycogen oxidized, as contrasted with the 3 bonds generated when a similar unit is glycolyzed. This means, in effect, that of the total available energy of the glycogen-store, the muscle enzymes can "capture" about 70 % in the form of ATP when working aerobically.

### 3. Extramuscular Energy

As has been mentioned, cells of kinds other than muscle also possess most or all of the catalytic equipment involved in glycolysis and oxidation. Here, as in muscle itself, the metabolic degradation of carbohydrate—and there can be little doubt that the same is true of the catabolism of fats—is associated with the generation of new energy-rich bonds and the synthesis of ATP. The question may therefore be asked: why, in cells that do not do mechanical work, do we find catalytic machinery that appears to be uniquely directed towards the synthesis of large amounts of this very peculiar compound? The answer is not far to seek. It is now known that ATP is not the immediate energy-source for muscular contraction alone: on the contrary, it appears to be the essential go-between in all the energy-producing and energy-consuming processes in cells of every kind. Thus, to take but a single example, glucose can be neither metabolized nor stored in the form of glycogen or starch without first being "primed", i.e. raised to a higher energy-level. This process of "priming" is accomplished by the transference

of phosphate to the glucose molecule from a molecule of ATP, a reaction that is catalyzed by the enzyme hexokinase. "Priming" is a wasteful process from the energetic point of view, for only some 20 % to 30 % of the energy lost to the ATP system finds its way into the newly-formed molecule of glucose-6-phosphate. Nevertheless, by undergoing an isomerization catalyzed by phosphoglucomutase, the 6-phosphate can be converted into  $\alpha$ -glucose-1-phosphate, which is the raw material for the enzymic synthesis of glycogen and starch (reversal of reaction 1). Alternatively the glucose-6-phosphate may be metabolized, but if it goes along the pathway of glycolysis an isomerization is again necessary, followed by a further "priming reaction" to yield fructofuranose-1 : 6-diphosphate (see reactions 3 and 4) before the hexose molecule becomes sufficiently unstable to be split by the enzymes of the cell.

It is a matter of great clinical interest in this connexion that it is to suppression of this "priming" process that the fundamental metabolic breakdown in diabetes mellitus is apparently due. Free glucose cannot be metabolized or stored unless it can first be "primed" by reaction with ATP under the influence of hexokinase. This enzyme is powerfully inhibited by a substance secreted by the anterior pituitary body, which accordingly opposes the storage and metabolism of glucose. Insulin acts by releasing the enzyme from the inhibition caused by the pituitary substance, and the activity of hexokinase is determined by the balance between the concentrations of the two hormones.

The energy-rich bonds of ATP, then, are of manifold importance. They furnish the immediate energy-source for muscular activity and they provide the "priming energy" necessary for the initiation of glucose-metabolism. Very possibly they play a similar part in the breakdown of fatty materials. They provide the energy needed for the synthesis of complex substances such as starch and glycogen from simpler units such as glucose, and there is evidence that they are also involved in the biosynthesis of many simpler compounds such as acetylcholine, glutamine, and hippuric acid. It is believed, moreover, that ATP plays an important part in the performance of the osmotic work necessary for selective absorption of glucose from the alimentary canal, and for its reabsorption from the glomerular filtrate by the renal tubule. It appears to be present and to play an important part in living organisms of every kind and, so far at any rate, no other substance of comparable importance in biological energetics has been brought to light.

\* \* \*

The knowledge and the discoveries so briefly reviewed in this article form but a minute fraction of the harvest gathered in by biochemistry within the last 30 years. That these discoveries, and the detection of so much simplicity behind a welter of detail and apparent complexity, should have been achieved during his own lifetime provides proof enough, should it be needed, of the inspiration of Hopkins' foresight and vision.

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## METABOLIC PROCESSES IN MICRO-ORGANISMS

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- 1 Anabolic processes
  - a Fermentation and phosphorylation
  - b Cell-building: vitamin needs
  - c Mutation: gene-control
- 2 Metabolic disturbance in the infected host
- 3 Disturbance of the metabolism of the parasite by chemotherapy

Microbes, particularly bacteria, are unique among biological forms in that study of their metabolic activity preceded the knowledge of their existence. Fermentation and infective disease have both been studied from the earliest times, but the causal agents in both cases awaited the development of the microscope and the master-mind of Pasteur to relate them conclusively together. Pasteur indeed carried this correlation along the first stage of its journey; he believed that both effects were linked with the physiological processes and needs of the causative microbe, but the unravelling of the mechanisms by which the metabolic processes of the cell produced the varying phenomena of fermentation and disease awaited later exploration.

### 1. Anabolic Processes

Pioneer work in elucidating the biochemical mechanisms by which the microbial cell brings about the chemical events of fermentation was due to Arthur Harden. In his classical studies on the fermentations by *Bact. coli* (Harden 1901) and *B. lactis aerogenes* (Harden & Walpole, 1906) he was the first to make a quantitative study of the products of a mixed bacterial fermentation with the purpose (i) of accounting quantitatively for the substrate fermented in the products of fermentation and (ii) of discovering by what intermediate steps the final stable end-products were produced from the original hexose. He thus laid the foundation on which later workers have built the modern structure of fermentation-chemistry.

#### a. Fermentation and Phosphorylation

Harden's second piece of pioneering was the discovery that fermentation was linked with the production of phosphate esters (Harden, 1932). It would be hard to exaggerate the importance of this observation; through its development it is now known (Barron, 1943) that all fermentations occur through intramolecular rearrangement, not of 6- and 3-carbon compounds as was thought earlier,

but of their phosphate esters through the system of intermediate reactions known as the Embden-Meyerhof-Parnas cycle. This, with minor variations, additions, and modifications, has now been proved to be the scheme into which fit all the ever-growing company of fermentations brought about by bacteria, moulds and other unicellular organisms, including free-living animal cells like spermatozoa. In this scheme, the fructose diphosphate discovered and isolated by Harden (1932, p. 58) holds a key position.

But the phosphorylations first studied by Harden have an even more profound biological meaning than that of forming the framework within which fermentations occur. Convergent evidence supplied by several workers (Meyerhof & Suranyi, 1927; Needham & Pillai, 1937) and ably summarized and extended by Lipmann (1941) has shown that the entry of phosphate into the fermentation-cycle results in the formation of phosphate-ester links whose energy content is c. 3,000 cal./mol.; and that the result of the changes which occur during the cycle is to concentrate the energy derived from the sugar molecule into an energy-rich bond in phosphopyruvic acid, so that the rupture of phosphate from this substance liberates c. 12,000 cal./mol. The fermentation-cycle thus provides the mechanism for concentrating the energy from the carbohydrate molecule into a form from which it can be either liberated or stored within the cell in the energy-rich bonds of adenosine pyrophosphate, whence it can be released to serve the anabolic processes in cell-synthesis. Even chemosynthetic (autotrophic) bacteria appear to work in this way, the energy liberated by the oxidation of sulphur being stored as phosphate esters to be used subsequently for the reduction of CO<sub>2</sub> required in the synthesis of carbohydrate and hence of other cell-material (Vöglér & Umbreit, 1942).

#### b. Cell-building: Vitamin Needs

In retrospect, the mechanism by which the energy-providing systems operate seems comparatively easy to elucidate, as compared with the formidable problem of the building up of cellular material from the substrate. The enzymes and coenzymes of oxidation and fermentation have now all been isolated, and their action in these processes can be followed in full detail in vitro. But between the products of digestion, whether of the animal or microbe, and the final appearance of the new cell, there remained for long a chasm of ignorance. It may fairly be claimed that the study of microbiological chemistry has played a large part in constructing the slender bridges so far thrown across this gulf. This is due largely to the greater tolerance of the microbe towards interference with its metabolic routine as compared with the more-highly-integrated animal organism, and to its much greater tendency to vary biochemically. The microbial cell shows its relationship with that of the animal in requiring for its growth and functioning the entire range of the B vitamins; in fact, several of these, e.g. biotin (Kögl & Tönnis, 1935), inositol (Eastcott, 1928) and *p*-aminobenzoic acid (Rubbo & Gillespie, 1940) were discovered in studies of microbial metabolism before their importance to the animal was recognized.

Many bacteria, yeasts and fungi are able to synthesize every member of the group, but many others, through prolonged cultivation in an environment where these compounds are present (due to the activities of animals, plants or other microbes), have lost certain synthetic powers

and require to have one or more of the vitamins supplied in their media. Such exacting organisms have furnished valuable information as to the function of the vitamin in question; grown on suboptimal concentrations of the factor, the deficient cells display subnormal activities of certain enzymes which—even in non-proliferating cells—function normally when the concentration of the factor is raised. Thus aneurin, or its pyrophosphate (vitamin  $B_1$ ), was known to be necessary for the oxidation of pyruvic acid by animal tissues and for its decarboxylation by yeasts; similar studies on bacteria by the method mentioned above have shown that it is necessary for other reactions in bacterial metabolism in which pyruvic acid is involved (Hills, 1938). To take another example: the active components of the  $B_6$  complex (pyridoxal phosphate and pyridoxamine) have been shown by this deficient-culture method to form parts of the enzymes catalyzing the transfer of amino-groups from certain amino-acids to certain keto-acids, thus possibly playing a part in the synthesis of proteins, whilst pyridoxal phosphate has been shown to act as coenzyme of the bacterial amino-acid decarboxylases (Gale, 1946). Work on yeast has shown that biotin functions in the assimilation of ammonia (Winzler, Burk & du Vigneaud, 1944), and studies of *L. plantarum* (Stephenson & Rowatt, 1947) have corroborated the observation that pantothenic acid functions in the acetylation of choline. The function of *p*-aminobenzoic acid as a vitamin was foretold through the discovery of its property of antagonizing the action of sulphonamides on bacteria (Woods, 1940). This prophecy was fulfilled within a year when it was shown to be a growth-factor for a strain of *Cl. acetobutylicum* (Rubbo & Gillespie, 1940).

### c. Mutation: Gene-control

The work of Beadle & Tatum (1941) in the USA has developed the use of the microbe—principally the mould *Neurospora crassa*—for the study of the biochemistry underlying mutation and gene-control. By the study of artificially-induced mutants they have suggested that each mutant arises by the loss of one gene which controls the production of one enzyme. If one of the enzymes involved in a chain of synthetic reactions is lost by the mutant, then the organism becomes nutritionally exacting towards the product of the step catalyzed by that enzyme. In this way, important information has been gained on the anabolic mechanisms of the cell. For example, it has been shown that anthranilic acid and indole are the serial precursors of tryptophan, the last step in the synthesis being the condensation of indole with serine (Tatum & Bonner, 1944), the same route being independently shown to hold for *Esch. coli* (Fildes, 1945). Similarly, the synthesis of arginine proceeds through ornithine and citrulline (Srb & Horowitz, 1944) whilst the immediate precursors of valine and isoleucine (Bonner, 1946) are the corresponding keto-acids.

The microbe thus supplies ideal biochemical material for the study of anabolic processes, giving results which may prove to be valid also for both animals and plants. It also promises to provide a clue to the mechanism by which the gene controls the production of enzymes and so controls the development of the cell. In the brilliant work of Avery, MacLeod & McCarty (1944) it has been shown

that the rough (non-encapsulated) Type II pneumococcus can be transformed permanently into a new type producing the polysaccharide capsule characteristic of Type III. This has been done by incorporating into the growth-medium of the rough form of the Type II organism minute amounts of a rigidly-purified desoxyribonucleic acid obtained by the disintegration of the Type III organism. This transformation seems to be equivalent to the incorporation in the Type II cell of a new gene controlling the enzymic production of the Type III polysaccharide.

## 2. Metabolic Disturbance in the Infected Host

So far we have considered problems of synthesis and growth common to all living cells, but medical science is especially interested in the mechanisms by which pathogenic organisms interfere with the metabolism of the mammalian host and cause the onset of disease. It must be admitted that here our knowledge is still fragmentary, but of recent years one or two breaches have been made in the brickwall of our ignorance. Thus certain strains of *Cl. welchii* have been shown to owe their disintegrating action on tissues to three enzymes: (i) a hyaluronidase (McClean, 1941) which disintegrates the polysaccharide hyaluronic acid, the substance forming the intercellular cementing material of tissues, and this disintegration assists the invasiveness of the organism; (ii) a lecithinase which disrupts the surface-membrane of cells and is in fact a cytolytic agent (Macfarlane & Knight 1941); (iii) a collagenase which attacks the collagen sheath of the muscle fibres, leaving behind a friable mass of fibrils with no protection (Macfarlane & MacLennan, 1945). Recent months have also witnessed the isolation in pure crystalline form of two powerful toxins, those of *Cl. botulinum* (Lavanna, McElroy & Eklund, 1946) and *Cl. tetanum* (Pillemer, Wittler & Grossberg, 1946). Both act in amazingly low concentration, L.D.50 (mouse) for the botulinum toxin being  $3.2 \times 10^{-5}$   $\mu$ g, from which it was computed that the L.D.50 for a man of average weight would be 0.12  $\mu$ g. This is the lowest concentration in which any poison is known to act. After these achievements it is probable that the disclosure of the mode of action of these toxins will not be long delayed.

## 3. Disturbance of the Metabolism of the Parasite by Chemotherapy

One of the most outstanding of recent medical advances has been in the realm of chemotherapy, a rational approach to the study of which was put forward by Fildes (1940); this was based on the idea that chemotherapeutic agents owe their activity to the similarity of their structure to that of essential metabolites whose activity they block by steric hindrance. The discovery that the sulphonamides were antagonized by *p*-aminobenzoic acid (Woods, 1940), later shown to be a growth-factor (Rubbo & Gillespie, 1940), corroborated this view and led to numerous attempts to produce chemotherapeutic agents by synthesizing analogues of other growth-factors and essential metabolites. Many such compounds have been prepared, as for example, analogues of nicotinic acid, pantothenic acid and some amino-acids by the replacement of the  $-\text{COOH}$  by  $-\text{SO}_3\text{H}$  (McIlwain & Hawking, 1943; Woolley, 1946). These compounds do indeed inhibit the growth in vitro of organisms

<sup>1</sup> [cf. *BMB* 1200, fig. 2.—Ed.]

which require the factors to which the compounds are structurally related, but so far no chemotherapeutic agents comparable in value to the sulphonamides have been produced by this means.

Another advance in the host-parasite relation comes from a different line of approach. It has long been recognized that non-spore-forming pathogens cannot long survive in the mixed microbial population of the soil. The mechanism of this biological antagonism was first investigated in a rational manner by Dubos (Dubos & Hotchkiss, 1941), who treated samples of soil with pathogenic cocci over a long period and then examined the population of the treated soil. He isolated an organism, later identified as *B. brevis*, which excretes into its environment a mixture of substances lethal or inhibitory to many other bacteria. Two substances, tyrocidin and gramicidin (Hotchkiss & Dubos, 1941; Hotchkiss, 1946), were isolated as crystalline polypeptides; the former is lethal to most bacteria and appears to act as a cytolytic agent, while the latter is bacteriostatic to gram-positive cocci. This work demonstrated how one organism can antagonize another by the excretion of a substance inhibitory towards the growth of the other. Recognition of this principle and its general exploitation has led to the production in recent years of scores of "antibiotic" substances. Many of these prove generally toxic, but at least two, namely penicillin and streptomycin (Schatz, Bugie & Waksman, 1944), are specifically toxic towards certain bacteria and can be used clinically as chemotherapeutic agents. The discovery of penicillin was an independent development following on the original observation of Fleming (Fleming, 1929) that a mould-colony excreted into the medium something which lysed staphylococcal colonies growing in the vicinity. The instability of the antibiotic proved an obstacle to its large-scale production and purification, but the obstacle was eventually overcome by Florey and his team of workers at Oxford (Chain *et al.* 1940), so that penicillin is now one of the most potent weapons available to medicine.

To the biochemist the chemotherapeutic agents are

mainly of interest as tools for the elucidation of growth-processes. The fact that they can be used clinically indicates that they act upon structures, or inhibit enzyme-systems, which are more important to the parasite than to the host, so that the elucidation of their mechanism should assist the development of our knowledge of parasitic existence. All these antibacterial substances prove to be selectively active against certain groups of bacteria; to many, the bacteria loosely classified as gram-positive prove more sensitive than the majority of gram-negative species. It has been found that the staining-complex responsible for the positive gram-reaction is a magnesium-ribonucleotide-complex residing in the surface of the organism (Henry & Stacey, 1943). It has further been found that the gram-positive cell differs from the gram-negative in that the former can assimilate certain amino-acids in the free state and concentrate them within the internal environment prior to metabolism—thus, presumably, compensating for the inability of many of these organisms to synthesize such amino-acids (Gale, 1947; Taylor, 1947). Investigation of the processes whereby the amino-acids migrate across the cell-wall against a concentration-gradient has shown that penicillin-treated cells are unable to assimilate glutamic acid and, consequently, to synthesize protein within the cell (Gale & Taylor, 1946). It has previously been shown that sulphonamides interfere with the metabolism of *p*-aminobenzoic acid and it is now known that this substance forms part of folic acid and other peptides within the cell. We have here, then, indications that the nature of chemotherapeutic interference is beginning to be revealed by the concentrated attacks of biochemistry on the structure and essential anabolism of the growing cell.

One may perhaps summarize the present position by saying that knowledge of bacterial metabolism is fundamental and crucial to the understanding of anabolic processes in general, and that its extended study is the main gateway to a comprehension of the chemical mechanism of infective disease and to the control of this by chemotherapeutic agents.

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## WIDER ASPECTS OF STUDIES OF THE NUTRITION OF MICRO-ORGANISMS\*

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- 1 Uniformity of fundamental cell-processes
  - 2 Function of essential metabolites
  - 3 Nutritional approach to bacterial chemotherapy
  - 4 Biosynthesis of essential metabolites
  - 5 Conclusion
- References

A complete understanding of the fundamental biochemistry of deficiency-diseases of animals involves the solution of two main problems. First, the precise function of the food-factor (vitamin or essential amino-acid) in cell-metabolism must be established; only in this way is it possible to determine the primary biochemical lesion resulting from lack of the factor, for it is possible that the clinical symptoms arise only indirectly from this lack. Second, the need for such factors implies that the animal in question is unable to synthesize them for itself. But this failure is not common to all organisms; plants and some micro-organisms are able to synthesize a wide variety of the substances required by animals. A detailed knowledge of the biosynthesis of these "essential metabolites" by such organisms may enable the cause of the failure in other organisms to be determined.

The main purpose of the present article is to examine what contribution the study of the nutrition of micro-organisms can make to the solution of these two problems. Work done in recent years suggests that information may be obtained which may have wide application to other cells.

### 1. UNIFORMITY OF FUNDAMENTAL CELL-PROCESSES

The development of the study of the nutrition of micro-organisms has been outlined by Knight (1945) and Fildes (1946)<sup>1</sup>. Many bacteria require for growth traces of complex organic compounds (essential growth-factors). As these substances were characterized they were found to be already known as vitamins for higher animals (e.g. aneurin, riboflavin, pyridoxin, choline). In recent years there has been an increasing tendency for this order to be reversed; factors first studied as growth-factors for micro-organisms (e.g.

nicotinic acid, pantothenic acid, biotin, folic acid, *p*-aminobenzoic acid, streptogenin<sup>2</sup>) have later been found to be important also in animal nutrition.

Some bacteria do not require growth-factors, or perhaps one or two only. Such organisms are found to synthesize the factors not required, or at any rate material with the same biological activity (Knight, 1945; Peterson & Peterson, 1945). It seems a reasonable deduction, therefore, that these factors are required for the normal metabolism of all bacteria and are recognizable as growth-factors or growth-stimulants only when the cell in question cannot synthesize them or can do so only at a suboptimal rate. The inclusive term "essential metabolite" has been proposed (Fildes, 1946) for such substances, which include various amino-acids.

The same essential metabolites are thus found to be required by animal cells and by cells of micro-organisms (bacteria, yeasts, lower fungi, protozoa). Many of them have also been implicated in the nutrition of insects and the isolated root-tips of higher plants (Knight, 1945; Peterson & Peterson, 1945). This uniformity of requirement for certain substances by cells of all types leads to the conclusion that the fundamental cell-reactions in which they are involved may be common to all cells. Thus aneurin or its phosphate esters have been found to function as coenzymes in pyruvate metabolism, e.g. oxidation by pigeon-brain (Banga, Ochoa & Peters, 1939), decarboxylation by yeast (Lohmann & Schuster, 1937), oxidation to acetic acid and CO<sub>2</sub> by *Bact. delbrueckii* (Lipmann, 1944) anaerobic and aerobic breakdown by *Staph. aureus* (Hills, 1938).

It is probable, therefore, that findings concerning the metabolic function of essential metabolites in micro-organisms will, in the main, be applicable to other cells. One important limitation must be noted. Some animal vitamins (notably the fat-soluble group and ascorbic acid) have not so far been found to be concerned in the nutrition of micro-organisms. Such substances may be required for the specialized functions of the differentiated tissues of higher organisms (e.g. vitamin D in calcification).

Micro-organisms have many advantages for the study of essential metabolites. During the stages of purification and identification, the routine biological tests give rapid results and the experimental criterion (growth) is simple to assess. Furthermore, "pure" cultures are used; in tests with animals there is always present, besides animal cells, a considerable bacterial population in the gut. Synthesis of vitamins by gut-organisms may contribute to the nutrition of the animal (Najjar & Barrett, 1945; Daft & Sebrell, 1945) and obscure the results. For later studies of metabolic function, bacterial cells deficient in a given factor may be obtained easily and rapidly by growing in a defined medium containing suboptimal amounts of the factor.

### 2. FUNCTION OF ESSENTIAL METABOLITES

It is obvious that the main function of essential amino-acids is for the synthesis of cell-proteins. Some, however, also occur in the structure of other growth-factors, e.g. glutamic acid in folic acid (Angier *et al.*, 1946) and unidentified amino-acids in streptogenin (Woolley, 1946b).

\* In a general review of this type it seemed undesirable to obscure the text by detailed references to the many hundreds of papers considered either directly or by implication. When possible, therefore, reference has been made to more detailed reviews of particular aspects, or to key-papers from which other references may be traced.

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<sup>1</sup> [BMB 929]

<sup>2</sup> For work on streptogenin see Woolley (1946a) and Scott, Norris & Heuser (1947).

Members of the vitamin-B complex have been found to be involved in the structure of coenzymes (or prosthetic groups) of various enzyme-systems. The role of aneurin in pyruvate metabolism has been mentioned above. Nicotinamide appears in the di- and triphosphopyridine dinucleotide coenzymes, and riboflavin in the flavoprotein enzymes, of oxidation-systems (Green, 1941). In the present review, attention will be focussed on other members of the B complex; the examples are chosen to illustrate the general methods of approach available with micro-organisms and the varying degrees of progress made.

### General Methods of Investigation

Progress has been made in the main by the use of various combinations of five methods, which are of general application.

A. Discovery that a component of the structure of a coenzyme is identical with, or related to, a known growth-factor.

B. Study of the metabolism of cells deficient in a factor, followed by detailed study of any metabolic process which is affected. It is possible, however, that the effect obtained may be secondary; lack of the factor may affect the synthesis of another factor more directly concerned.

C. Study of the metabolism of the factor itself may provide a hint as to whether it (i) must be built up to a more complex molecule before it can function, or (ii) undergoes some reversible change whilst functioning.

D. The factor may be replaceable in growth-tests by a substance X of a different chemical type. This may suggest that the factor is concerned with the synthesis of X or vice versa.

E. Use of substances, often analogues of the factor (anti-metabolite inhibitors, *v. infra*), which may specifically inhibit the utilization of the factor and lead to a breakdown of the metabolic processes with which it is concerned.

### The Vitamin B<sub>6</sub> Group

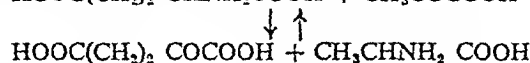
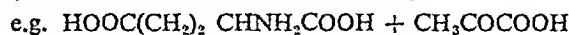
#### Decarboxylation of amino-acids

The identification of pyridoxal phosphate<sup>3</sup> (fig. 1) as the coenzyme of various amino-acid decarboxylase enzymes of bacteria provides a striking example of the joint application of methods (A) and (B).<sup>4</sup> This work was carried out by Gale and colleagues (mainly A) and by Gunsalus and colleagues (B); it has been fully reviewed by Gale (1946). Cells of the main test-organism (*Str. faecalis* R) deficient in pyridoxin were obtained (a) from a medium containing suboptimal amounts of pyridoxin (b) from a medium in which pyridoxin was replaced by *dl*-alanine

(Bellamy & Gunsalus, 1945; Snell, 1945a). An important step forward in this research came from the observation of Snell (1944) that pyridoxal and pyridoxamine had greater growth-promoting activity for some micro-organisms than pyridoxin itself. Further support for the role of the phosphate ester comes from the finding (C) that pyridoxin, pyridoxal, and pyridoxamine can be converted to pyridoxal phosphate by organisms which can use them for growth (Bellamy, Umbreit & Gunsalus, 1945).

#### Transaminase reactions

Snell (1944, 1945b) suggested that a pyridoxal = pyridoxamine transformation might act catalytically in transamination reactions by acting as an intermediate carrier of amino-groups. It has now been found (B) that pyridoxal and pyridoxamine phosphates are both active as coenzyme with cell-free preparations of *Str. faecalis* R, catalyzing transamination between glutamic and oxaloacetic or pyruvic acids (Lichstein, Gunsalus & Umbreit, 1945; Umbreit, O'Kane & Gunsalus, 1946)



Pyridoxamine phosphate is not, however, active as codecarboxylase.

Transamination reactions also occur in animal cells. Here pyridoxal phosphate has now been found to act as coenzyme with the glutamic-aspartic and glutamic-alanine transaminases (Braunstein, Kritzmann, Gale, Tomlinson & Samarina, 1946; Ames, Sarma & Elvehjem, 1947).

#### Metabolism of tryptophan

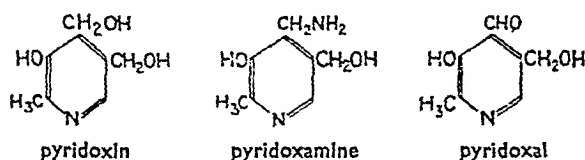
The final stage in the synthesis of tryptophan by the mould *Neurospora* is the condensation of indole and serine (see p. 311). Pyridoxal phosphate acts as coenzyme in this condensation (Umbreit, Wood & Gunsalus, 1946). There is also evidence (see p. 312) that pyridoxin derivatives are involved in the synthesis of tryptophan by *Lactobacillus arabinosus* (Schweigert, 1947). On the catabolic side, pyridoxal phosphate has been found to be one of the coenzymes involved in the breakdown of tryptophan to indole by *Esch. coli* (Dawes, Dawson & Happold, 1947; Wood, Gunsalus & Umbreit, 1947).

With animals it is found that pyridoxin-deficient rats (B) fed with tryptophan excrete xanthurenic acid (an abnormal product). Feeding of a desoxy-analogue (E) of pyridoxin (which presumably inhibits the function of pyridoxin) leads to excretion of the same acid by both normal and deficient rats (Lepkovsky, Roboz & Haagen-Smit, 1943; Porter, Clark & Silber, 1947).

#### Synthesis of other amino-acids

With certain species of *Lactobacilli*, the growth requirement for several amino-acids is abolished if pyridoxin is present (D). In some cases CO<sub>2</sub> is also necessary. Where tested, pyridoxal and pyridoxamine were more active than pyridoxin. Since organisms growing under these conditions were shown to synthesize the amino-acids in question, it appears that pyridoxin plays an essential part in their synthesis (Stokes & Gunness, 1945; Lyman *et al.*, 1947).

FIG. 1



<sup>3</sup> The position of the phosphate group in pyridoxal phosphate is not yet clear. Recent work (Gunsalus & Umbreit, 1947) appears to exclude the possibility that the phenolic group is phosphorylated.

<sup>4</sup> Capital letters refer to the general methods outlined in the previous section.

### Conclusions

Work with bacteria shows that the biologically-active forms of pyridoxin are pyridoxal and pyridoxamine phosphates. These compounds appear to have a general coenzyme function in amino-acid metabolism (both breakdown and synthesis) and there is some evidence for a similar role in animals.

### Pantothenic acid

McIlwain (1946) has studied this factor mainly by methods (B), (C) and (E). He finds that pantothenate is metabolized (concurrently with glucose-fermentation) by organisms requiring it for growth. This metabolism is inhibited by the same pantothenate analogues (e.g. pantoyltaurine) which inhibit growth, and appears to be connected with growth-factor function. It is suggested that the metabolism may yield a substance which is essential for growth. The necessity for a coupled energy-yielding reaction suggests the formation of a more complex molecule, and this may be consistent with the finding of Lipmann *et al.* (1947), that the coenzyme for the acetylation of choline by brain-tissue is a pantothenate derivative from which pantothenate may be liberated by enzyme treatment. Stephenson & Rowatt (1947) also find that pantothenate is required for the acetylation of choline by a strain of *Lactobacillus plantarum*; suspensions of deficient cells had low activity which was much increased by pantothenate (B).

Pantothenate-deficient cells (B) of *Proteus morganii* show decreased aerobic and anaerobic metabolism of pyruvate (Dorfman, Berkman & Koser, 1942; Hills, 1943). There are also findings (D) that the tryptophan requirement of *Staph. aureus* can be met by pantothenate plus glucose (Sevag & Green, 1944), and the pantothenate requirement of *Cl. botulinum* by aneurin plus choline (Lamanna & Lewis, 1946). It is possible that pantothenate is concerned with a key-reaction (involving acetylation or acetate metabolism?) common to these systems.

### Biotin

Several studies implicate this factor in nitrogen metabolism. Biotin-deficient cells of *Saccharomyces cerevisiae* have greatly-depressed rates of respiration and fermentation (B), and these are raised by biotin plus ammonia, but not by either alone. Assimilation of ammonia from the medium by such cells was found to depend on the presence of biotin (Winzler, Burk & du Vigneaud, 1944). There is evidence (D) that biotin is involved in the synthesis of aspartic acid, since (a) the stimulating effect of biotin on the growth of *Torula cremoris* can be partially replaced by this amino-acid (Koser, Wright & Dorfman, 1942), and (b) the aspartic-acid requirement of certain lactic-acid bacteria is abolished if sufficient biotin is present. Organisms growing with biotin alone were found to contain as much aspartate as those actually grown with aspartate. Since some biotin is required even when aspartate is supplied, it follows that synthesis of this amino-acid is not the only function of the factor (Stokes, Larsen & Gunness, 1947).

### p-Aminobenzoic Acid

The role of p-aminobenzoic acid as an essential metabolite was predicted from its properties in overcoming the

inhibition of bacterial growth by sulphonamide drugs (Woods, 1940). The prediction has been fulfilled by the discovery of many micro-organisms which require this substance as an essential growth-factor (see Knight, 1945; Woods, 1947). It has also been implicated in animal nutrition (Ansbacher, 1944). Elucidation of the metabolic function of p-aminobenzoic acid should therefore throw further light on the fundamental mode of action of the sulphonamides. The original hypothesis suggested that the sulphonamides inhibit competitively enzyme-reactions involved in the utilization of p-aminobenzoic acid by the cell, and considerable information as to the nature of these reactions is now available. Since sulphonamides are inhibitors of the utilization of this factor, method (E) has yielded much information. Method (D) has been applied to organisms (including induced mutants) requiring p-aminobenzoic acid for growth, and has also been very helpful. It is possible in the space available only to summarize the present position, but a more detailed analysis of the evidence and full references are given by Woods (1947).

Folic acid is another essential metabolite for micro-organisms (and for higher animals), and the molecule is now known to contain a p-aminobenzoic-acid residue. Within a limited group of bacteria, requirement for folic-acid synthesis appears to be the only function of p-aminobenzoic acid, and to be the only point of inhibition by sulphonamides. With other bacteria, however, there is evidence that this factor is also involved in the synthesis of purines, thymine and methionine, and that sulphonamides also inhibit these functions. With the nucleic-acid derivatives it is possible that the effect occurs through the intermediate production of folic acid, but with methionine the mechanism is unknown. It may be noted that various purines and pyrimidines and methionine are also essential metabolites, and appear as growth-factors for many micro-organisms.

### 3. NUTRITIONAL APPROACH TO BACTERIAL CHEMOTHERAPY

The development of the idea that the action of drugs may be due in some cases to inhibition of an enzyme, and that this inhibition occurs by virtue of a structural relationship between the drug and the natural substrate, has been discussed by McIlwain (1943), Woolley (1946c) and Roblin (1946). The discovery that p-aminobenzoic acid overcomes the inhibition of bacterial growth by sulphonamides (to which it is structurally related) and that it is an essential metabolite for bacteria (*v. supra*), has stimulated a search for analogues of other essential metabolites which might inhibit bacterial growth in a similar manner. It was hoped that such substances (often called metabolite antagonists) might also prove to be useful chemotherapeutic agents (Fildes, 1940a). A large number of such compounds has now been tested and many of them inhibit the growth of various bacteria, usually species which require the metabolite in question as a growth-factor. On the other hand, only one or two substances with appreciable therapeutic value have so far been obtained (Roblin, 1946; Woolley, 1946c, 1947). Many other properties besides capacity to inhibit bacterial growth will determine the therapeutic value of a substance (McIlwain, 1944); amongst these are

the rates of absorption, excretion and possible destruction by the tissues of the host-animal. Furthermore, the bulk of these metabolite antagonists have been modelled on substances which are equally as important for the host-cells as for the micro-organisms (see p. 308) and are likely to inhibit important metabolic processes of both (absorption, etc. being equal). Indeed, characteristic symptoms of the corresponding vitamin-deficiency disease have been found to follow the administration to animals of several of these inhibitors (Woolley, 1946c).

In the control of bacterial infections it may often be sufficient to prevent growth for a limited period whilst the defence-mechanisms of the host cope with the situation. In these circumstances, a short-term interruption of cell-multiplication processes is less likely to do harm to the adult host than to the bacterium. It is possible, therefore, that the metabolite-antagonist approach would yield a higher dividend if it could be applied to essential metabolites more specifically concerned with cell-division, but this must await the characterization of such metabolites.

Apart from possible applications to chemotherapy, metabolite-analogues have been used with much profit as specific inhibitors in fundamental biochemical studies. A number of examples of this has been given in other sections of this review.

#### 4. BIOSYNTHESIS OF ESSENTIAL METABOLITES

It has been pointed out (p. 308) that substances recognized as growth-factors for particular micro-organisms are probably essential for the growth of most micro-organisms, the difference being that some organisms can achieve their synthesis whilst others cannot. If a number of organisms require the same growth-factor, the power to synthesize it may have failed with different organisms at different stages of the series of reactions by which the synthesis is accomplished; the provision of intermediates above the point of failure will enable the synthesis to be completed and the organism to grow. Thus ammonia, nicotinic acid, nicotinamide and nicotinamide-riboside have been proposed as intermediates in the synthesis of phosphopyridinedinucleotide coenzymes, since a series of organisms exists in which each of these substances is the simplest molecule which will support growth in the absence of the higher forms (Knight, 1945). Similar evidence can often be obtained with a single species if a number of strains or mutants, each requiring the same growth-factor, are available for study. The outstanding work of Beadle (1945) and his colleagues with induced mutants of *Neurospora* has proved the value of this technique. By x- or ultra-violet irradiation of this mould, a number of "biochemical" mutants were obtained, each differing from the parent in requiring one further growth-factor. Similar mutants have been obtained by treatment with mustard-gas or its nitrogen analogue (Horowitz *et al.*, 1946). Mutants requiring most members of the vitamin-B complex and a number of amino-acids have now been isolated. These mutants are genetically dissimilar from the parent-strain and from one another, which suggests that the synthesis of individual metabolites is controlled by distinct genes. In a number of cases (e.g. tryptophan, arginine) two or more genetically-dissimilar mutants requiring the same factor have been found, and analysis of response to possible intermediates has shown

that the synthesis has broken down at different points. Thus, individual steps in the synthesis of a growth-factor may be controlled by different genes.

Analogous biochemical mutants of bacteria have been obtained by similar treatments and by the action of bacteriophage (Roepke, Libby & Small, 1944; Tatum, 1945; Lederberg & Tatum, 1946; Anderson, 1946). With bacteria there can be no genetic analysis, and therefore no hint as to which of a number of mutants requiring the same factor are likely to be biochemically dissimilar in detail.

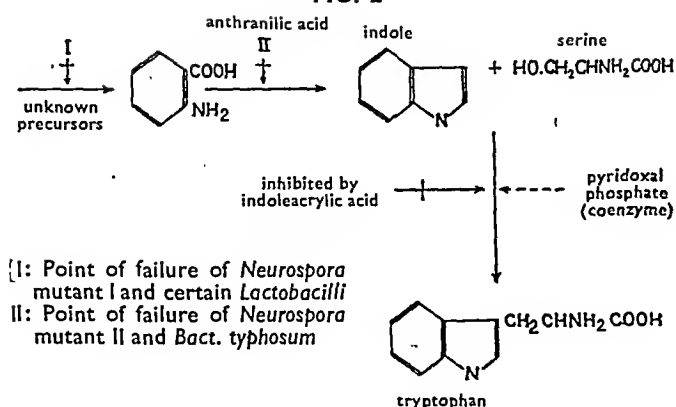
If an exacting organism is grown in the presence of the growth-factor required, the intermediate compound corresponding to the point of failure of the synthetic chain is sometimes formed and accumulates in the medium. Thus a nicotinamide-requiring mutant of *Neurospora* produces a substance (probably an oxypyridine carboxylic acid) which promotes the full growth of another, but genetically distinct, mutant, and is therefore probably an intermediate in the synthesis of nicotinamide (Bonner & Beadle, 1946). Accumulation of precursors may also occur when growth is limited by specific inhibitors of the utilization of a metabolite (Fildes, 1945). Such growth-inhibitions may, if competitive in nature, yield further information; addition of the product of the inhibited reaction should promote growth irrespective of the concentration of the inhibitor, or (Shive & Macow, 1946) may raise the concentration of inhibitor required if the latter also affects other reactions.

This nutritional approach to problems of biosynthesis is as yet in its infancy, but shows great promise. Limitation of space precludes a full account of its application, but the case of tryptophan will be examined since it illustrates well many of the above points.

#### Tryptophan

Evidence that anthranilic acid and indole are intermediates in the biosynthesis of this amino-acid was first obtained from observations that the tryptophan requirement of *Bact. typhosum* could be met by indole, and that of *L. arabinosus* and *L. casei* by indole or anthranilic acid (Fildes, 1940b; Snell, 1943). Tatum & Bonner (1944) then isolated two genetically-distinct mutants of *Neurospora*, each requiring tryptophan. Mutant I also grew if given indole or anthranilic acid, but Mutant II responded only to indole. Furthermore, anthranilic acid accumulated when Mutant II was grown in the presence of tryptophan or indole. The role of anthranilic acid and indole as intermediates was therefore confirmed and their order of formation established (see fig. 2). It was next found that tryptophan was produced if washed mycelium of Mutant II was incubated with indole and serine. The final stage of the synthesis is thus the direct condensation of indole and serine; pyridoxal phosphate has since been shown (see p. 309) to act as coenzyme in this reaction. Additional evidence that the scheme given in fig. 2 applies also to bacteria has been obtained by different methods. 3-Indoleacrylic acid inhibits the growth of bacteria and the inhibition is overcome non-competitively by traces of tryptophan; this substance is therefore a specific inhibitor of tryptophan synthesis. A strain of *Bact. typhosum* (trained to grow without either indole or tryptophan) was found to accumulate indole in the medium when growth was partially suppressed by indoleacrylic acid; furthermore, inhibition

FIG. 2



of growth was much reduced if serine were added (Fildes, 1945). The growth-response of *L. arabinosus* to indole has been studied by Schweigert (1947) with an amino-acid medium not containing serine. Growth was poor unless both serine (or acetate) and derivatives of pyridoxine were added. A response equivalent to that given by tryptophan was finally attained in a medium containing pyridoxin, serine and acetate; the function of acetate is not clear. Since anthranilic acid did not promote full growth even in

a casein-digest medium supplemented with pyridoxin and acetate, it follows that other substances are involved in the conversion of anthranilic acid to indole.

The final stages in the biosynthesis of tryptophan by micro-organisms are thus established with reasonable certainty and in some detail. Outstanding problems are the precise mechanism of the anthranilic-acid-indole conversion, and the nature of the precursors of the former substance. The observation (Sevag & Green, 1944) that pantothenate plus glucose can replace tryptophan for *Staph. aureus* may have some relation to these problems.

## 5. CONCLUSION

The purpose of this review has been to illustrate the contribution which studies of the nutrition of micro-organisms can make to several outstanding problems of general cell-nutrition. It is not suggested that this is the only approach, and it is clear that the results should not be taken to have general application to all cells until confirmatory evidence has been obtained. Apart from the intrinsic interest to microbiological chemistry, it does appear, however, that information obtained by relatively-simple techniques with micro-organisms may give a valuable directive for similar types of research with other cells.

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## DEVELOPMENT AND THEORETICAL SIGNIFICANCE OF BRITISH ANTI-LEWISITE (BAL)

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- 1 Biochemical lesions and the pyruvate-oxidase system
  - 2 Arsenical researches
  - 3 Further theoretical points
  - 4 General implications
- References

British Anti-Lewisite (BAL) is the name given in the USA to 2:3-dimercaptopropanol, which was developed in Oxford during the first 18 months of the war as an antidote to the arsenical vesicants (see Peters, Stocken & Thompson, 1945)<sup>47 71 74</sup>. In this account, the threads which were woven into the pattern of the final research will be sketched and some details of the behaviour of BAL itself, and of its theoretical significance, will be included. The therapeutic applications in medicine are being treated elsewhere<sup>4</sup> (Thompson, 1947)<sup>64</sup>.

Some general remarks will clarify the subsequent account; (i) Very broadly, there are three kinds of toxic arsenicals, viz. arsenite, the therapeutic arsenicals such as arsphenamine  $\text{OH} \begin{array}{c} \diagup \diagdown \\ \text{NH}_2 \end{array} \text{As} = \text{As} \begin{array}{c} \diagup \diagdown \\ \text{NH}_2 \end{array} \text{OH}$  and compounds

of significance for chemical warfare such as diphenylchloroarsine and lewisite ( $\text{CH}_3\text{Cl} : \text{CH}:\text{AsCl}_2$ ). It is a reasonable view<sup>69</sup> that the toxicity of arsphenamine is due to the oxidation-product, the trivalent arsenoxide<sup>b</sup>  $\text{OH} \begin{array}{c} \diagup \diagdown \\ \text{NH}_2 \end{array} \text{AsO}$ . (ii) Much of our work has been con-

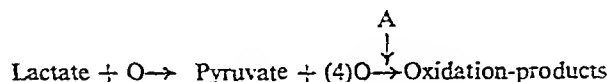
cerned with SH groups, which, following theoretical suggestions of Heffter & Arnold, were the subject of extensive research by Gowland Hopkins (1921, 1929)<sup>25 26</sup>, who first isolated the SH compound—glutathione—which is present in the tissues, and demonstrated its properties; in particular, it may be noted that the characteristic purple reaction with sodium nitroprusside and ammonia is given not only by soluble substances in the tissues, but also by SH groups linked to insoluble proteins such as skin and boiled muscle-tissue, the so-called "fixed SH groups". (iii) Lastly, it should be made clear that chemical-warfare agents, in concentrations which are profoundly toxic to cells, are not general protoplasmic precipitants. Their action is much more subtle.

### 1. Biochemical Lesions and the Pyruvate-oxidase System

At least two events give rise to a blister of the skin: the initial biochemical lesion, and the more complex pathological response following in its train. The development of the antidote depended upon knowledge of the initial biochemical lesion<sup>c</sup>, and has been a curious mixture of planned and unplanned research. As much of the work involved the use of the pyruvate-oxidase system, it is appropriate to recall briefly some of our work upon the biochemical lesion in vitamin-B<sub>1</sub> deficiency<sup>33</sup>. By this term is meant the initial change in tissue-cells which precedes any damage visible with the microscope. For many years we studied in this connexion the condition of opisthotonus in the rice-fed pigeon due to vitamin-B<sub>1</sub> deficiency, a condition which is completely reversible in 30 minutes or less by appropriate injection of the vitamin (for review see references 40, 42). After ten years' work, it was proved (Banga, Ochoa & Peters, 1939)<sup>2</sup> that this convulsive condition is solely due to lack of the co-factor (aneurin- or thiamin-pyrophosphate)<sup>d</sup> in the brain-tissue, with a consequent interruption of carbohydrate degradation at the stage of pyruvate; energy-giving reactions therefore fail. Some of this research was used in the war-work.

Turning to a few details: the research rested upon the discovery of the specific action in vitro of vitamin B<sub>1</sub> upon the avitaminous brain in the presence of pyruvate ( $\text{CH}_3\text{CO}\cdot\text{COO}-$ ), or a pyruvate-yielding substrate; most of it involved observation of the respiration in vitro of mashed pigeon-brain tissue, called "brei", in which all outlines are destroyed, but nuclei remain mainly intact. The diagram (fig. 1) indicates the course of the reaction for brain-tissue respiring in vitro in lactate solutions of pH 7.35.

FIG. 1



In this reaction about two-thirds of the pyruvate is completely burned to  $\text{CO}_2 + \text{H}_2\text{O}$ ; the remainder is lost mainly by a side-reaction to acetate. Lack of aneurin-pyrophosphate interrupts the reactions at A, leading to accumulation of pyruvate in vitro<sup>48</sup>, and in vivo to large increases in the content of pyruvate in the blood in the final stage of the deficiency<sup>65</sup>. It is the only known biochemical difference between the brain of the convulsing pigeon and the normal brain.

### 2. Arsenical Researches

For proper perspective, it may be recalled that arsenicals were first used as toxic smokes in World War I; working under J. Barcroft, the writer well remembers the active research engendered by this, and at that time an attempt was made (McClelland & Peters, 1919)<sup>22</sup> to get some rules for the toxicity of such trivalent arsenicals to ciliates; in addition to the finding that aromatic compounds were more toxic than aliphatic, there emerged the important point that the oxides formed by hydrolysis were at least as toxic

<sup>a</sup> [BMB 1199]  
<sup>b</sup> L. Pauling has told the writer that he considers that the usually-accepted formula is not correct.

<sup>c</sup> A term introduced by Gavrilescu & Peters (1931)<sup>72</sup>.  
<sup>d</sup> Also called cocarboxylase.

as the corresponding chlorides. Arsenical compounds, after penetrating the skin as chlorides and hydrolyzing in contact with aqueous phases in the tissue, are still toxic, which is an important distinction from mustard-gas. About this time (1917) lewisite was discovered in the USA; as subsequent events showed, it was a highly significant substance.

Our researches in World War II for antidotes to the war gases were based upon two ideas: (i) that an SH group was attacked by the As<sup>e</sup> and (ii) that this was a constituent of the pyruvate-oxidase system. The work leading to these ideas will be briefly traced.

### SH Groups and Arsenicals

Following the work at Porton in World War I, the writer undertook fundamental investigations in the Chemical Defence field, and E. Walker came to help him. It was found that mustard-gas sulphone<sup>50</sup> stopped the glutathione catalysis of muscle-tissue just then described by Hopkins & Dixon (1922)<sup>27</sup>; as a fixed SH group is part of this system, there followed the finding that several vesicants abolished the reaction for this in muscle, skin and trachea, and that this occurred not only with the sulphone mentioned but also with diphenylchloroarsine and allyl isothiocyanate. At this stage we were much interested by the appearance of work upon therapeutic arsenicals by Voegtlin, Dyer & Leonard (1923)<sup>68</sup>, in which they showed that arsenoxide combined with glutathione in SH form, and that monothiol compounds in rather large excess protected against the toxicity of the arsenical. This led<sup>f</sup> to a test, with good effect, of the protective action of the monothiol thioglycolic acid and of monothioethylene glycol against diphenylchloroarsine in ciliates, and to some evidence for reversal of toxicity. Though convinced then of a connexion between the toxicity of these arsenicals and mustard-gas sulphone<sup>g</sup> and a combination with SH groups, a conviction also shared by Voegtlin (1925)<sup>67</sup> for the therapeutic arsenicals, our research was discontinued in 1926, largely owing to the lack of information as to the significance of the sulphur system.

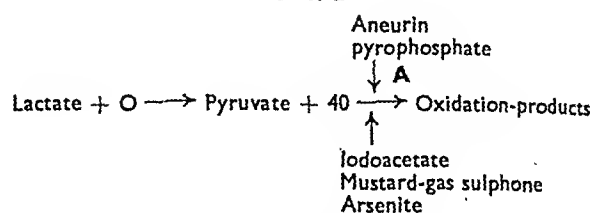
Meanwhile, this connexion was strengthened by other work which was continued in relation to the therapeutic arsenicals, especially by Voegtlin's group and by Eagle (1939)<sup>16</sup>; Rosenthal (1932)<sup>54</sup> also found indirect evidence for the combination of arsenoxide with the SH groups of denatured albumen. During this time, also, it was shown (Cohen, King & Strangeways, 1931)<sup>8</sup> that thioarsinites were dissociated in alkaline solution, e.g. the equation  $RAsO + 2R'SH \rightleftharpoons RAs(SR')_2 + H_2O$  was reversible; an observation which we thought was a valuable pointer to the possibility of therapeutic reversal.

### Pyruvate-oxidase System and Arsenicals

The idea that chemical-warfare agents attacked cell-enzymes was early mooted<sup>20</sup>, though no proof was given, nor could we get evidence for this<sup>50</sup>. During the vitamin-B<sub>1</sub> researches, however, an observation was made which to the

writer<sup>40</sup> reopened the whole question of enzymes in relation to the problem. We had found (fig. 2) that

FIG. 2



iodoacetate interfered positively at A in a *normal* pigeon-brain brei in a similar way to the negative interference produced by vitamin-B<sub>1</sub> deficiency; both led to accumulation of pyruvate from lactate (Peters, Rydin & Thompson, 1935)<sup>44</sup>. The important fresh point was that small concentrations of mustard-gas sulphone ( $0.09 \times 10^{-3}M$ ) acted similarly; since other enzymes concerned in the brei (i.e. the cytochrome-system) were by inference unaffected, this experiment indicated a selective action of the poison upon the pyruvate-oxidase system. Iodoacetate is a weak vesicant; hence a causal connexion was suggested between the selective enzyme-attack and the biochemical lesion leading to vesication. About the same time, this was extended by the observation that minute amounts of arsenite (see reference 45) had a similar action<sup>h</sup>. The analogy with iodoacetate was especially interesting because work at that time in 1932-33<sup>11 62 63</sup> had led to the view that inhibitions produced by it were due to interaction with SH groups. Combined with the earlier observations upon arsenicals, it led to the suggestion that various poisons attacked an SH group in the pyruvate-oxidase system<sup>41</sup>.

Very early in World War II, after retesting some of these points, the writer felt prepared to initiate, defend and direct a programme of extramural research for the Ministry of Supply with the object of reaching antidotes for mustard-gas and lewisite based upon the two ideas presented above, and upon confidence in those around him in his laboratory. The matter is put this way intentionally; though biochemists have a natural faith in enzymes, and though we had then proof of the profound pathological effect of failure of cocarboxylase in vitamin-B<sub>1</sub> deficiency, the idea that toxic effects upon an enzyme could initiate such a complicated process as vesication was not then at all acceptable in physiological and medical circles, or in those of pure chemistry; nor was it thought likely that any poisoning could be reversed. One can well understand the hesitation felt, especially when in addition the reservation of personnel in war was in question.

The team who embarked upon this work were roughly divided so that at the start H. M. Sinclair & R. H. S. Thompson worked upon arsenical substances, and E. R. Holiday, A. G. Ogston, J. St.L. Philpot, L. A. Stocken & R. W. Wakelin upon mustard gas; but the work went forward as a whole, and there was constant discussion by all of the research group. After some ten months, Sinclair and Philpot left for other work; but later V. P. Whittaker and G. H. Spray joined.

It was soon confirmed that, among several enzymes examined, the pyruvate-oxidase system was by far the most

<sup>e</sup> A nitrogen group could not be absolutely excluded at that time, but was thought unlikely.

<sup>f</sup> Walker, E., 1925 (published 1928)<sup>70</sup>.

<sup>g</sup> Mustard-gas itself is an exception<sup>42</sup>.

<sup>h</sup> Krebs (1933) had previously claimed a specific effect upon  $\alpha$ -keto-acid oxidase; his concentrations of As were however too large to settle this<sup>43</sup>.

sensitive to lewisite and arsenite (Peters, Sinclair & Thompson, 1946)<sup>45</sup>. We also got more evidence for the presence of an essential SH group, because the enzyme system was inhibited by maleate and -S-S- compounds<sup>49</sup>. Both of these reagents had been introduced by Hopkins and his school<sup>28, 37</sup> for the detection of SH enzymes. Succinodihydrogenase is also present in brain brei and is an SH enzyme<sup>14</sup>; but it is less sensitive, so that at low concentrations of the arsenical, there is selective poisoning of the pyruvate-oxidase system<sup>1</sup>. Hence pyruvate should accumulate in the blood of an animal poisoned with these arsenicals, as happens in vitamin-B<sub>1</sub> deficiency. Table I shows that there is an increased concentration in the blood after poisoning with As.

TABLE I. EFFECT OF INJECTED ARSENITE ON THE BLOOD-PYRUVATE LEVEL OF PIGEONS

(Expressed as mg. pyruvic acid/100 g. blood, as determined by 2,4-dinitrophenylhydrazine method. Duration of intoxication given in parentheses.)

Normal	Acute	Chronic	Total dose As <sub>2</sub> O <sub>3</sub> (mg.)
1.28	4.02 (2 hr.)	12.39 (4 days)	8.5
0.94	3.00 (2 hr.)	14.15 (4 days)	8.5
0.94	3.12 (2 hr.)	13.85 (43 days)	7
	6.30 (3 hr.)		
Average	1.06	4.11	13.47

Similar results were obtained for bisulphite-binding capacity (B.B.S.) of the blood in pigeons, and for pyruvate and B.B.S. with arsenite and lewisite in rats.

Data of Peters, Sinclair & Thompson, 1946<sup>45</sup>

This formed the background for the use of the pyruvate-oxidase system as an enzyme for in vitro tests of arsenical antidotes, and it has never failed. Evidence was also produced (Thompson, 1946)<sup>43</sup> that pyruvate oxidation in skin was inhibited by lewisite. Nevertheless, at this stage there were still facts difficult to fit with the main ideas; perhaps the most serious of these was the complete failure to protect animals or even the brain-enzymes against the toxicity of these arsenicals (Sinclair, 1940)<sup>65</sup> by large concentrations of monothiols, a somewhat different finding from that of the Voegtlin school for arsenoxide. In the early summer of 1940, the war-situation was more serious; this meant a sharpened scepticism as to the value of enzyme research as a contribution to the war-effort, which finally led to the official discontinuance of the enzyme work; nevertheless the arsenical research was continued upon the basis of looking for possible specific antibodies to arsenical proteins which might be formed by lewisite<sup>1</sup>. It should be realized that during all this year thiol-compounds were being made (mainly by L. A. Stocken) in relation to the mustard-gas work; though the more obvious avenues in the arsenical work were now narrowing, there was still left the systematic study of the relative dissociation of various thioarsenites, often urged by Philpot; however the crucial experiment came differently. In connexion with the research into the arsenical "immune proteins", our colleagues Stocken &

Thompson (1946a)<sup>59</sup> started to make, and analyze for As-content, arsenical compounds of keratine (Goddard & Michaelis, 1934)<sup>22</sup>, which is a reduced keratin, rich in SH groups. For lewisite-keratine compounds made under biological conditions of pH and at room-temperature, it was found that from lewisite the amount of arsenic taken up in combination was limited; it was not increased by exposure to a considerable excess, and in great part the amount combined was conditioned by the presence of

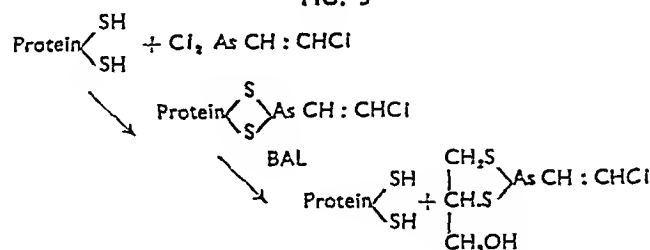
TABLE II. ANALYSIS OF ARSENIC DERIVATIONS OF KERATEINE AFTER EXPOSURE TO EXCESS OF THE ARSENICAL

Substance	Arsenical	S %	As %
kerateine	lewisite	1.36	0.58
		—	0.48
		1.32	0.63
		1.41	0.46
		1.31	0.47
		—	0.53
			0.52 % mean
	sodium arsenite		0.41 % mean (4 experiments)
metakeratin	lewisite	1.22	0.04
		1.37	0.07
		—	0.05 % mean

Data of Stocken & Thompson, 1946a<sup>59</sup>

-SH groups as such. With metakeratin, in which the SH groups have been oxidized to SS, the amount of As combined is no more than that from arsenate—about 0.05%. The lewisite-keratine was resistant to reprecipitation and dialysis. Most important of all, more -SH groups disappeared than As atoms bound by the keratine; from this, there followed the conclusion that some 75% of As must be bound in ring form with the protein SH. Since ring compounds would be expected to be a more stable combination, there emerged the "dithiol" theory (Stocken & Thompson), according to which the special stability of this enzyme "thio-arsenite" was due to the presence of two -SH groups upon a component of the enzyme so placed that a ring could be formed with a trivalent arsenical. It could be surmised that if a suitable dithiol could be found, able to form a more stable compound, as in fig. 3, it would

FIG. 3

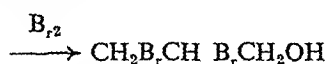
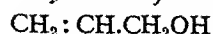


reverse the combination with the tissue-protein. After preliminary trial of two dithiols, the new compound 2:3-dimercaptopropanol was synthesized (Stocken, 1947)<sup>61</sup>; ultimately this was called BAL (British Anti-Lewisite) by the workers in the USA—a courteous gesture; so nearly allied to glycerol, this substance has excellent penetrant properties for skin.

<sup>1</sup> It is interesting to note that the total oxidase-system is more sensitive to arsenite than the pyruvate-dehydrogenase component.

<sup>2</sup> All credit should be given to Mr. J. Davidson Pratt (and the Ministry concerned) for taking the responsibility of active support at this stage.

Synthesis of 2:3-dimercaptopropanol (BAL)



It is indeed a curious coincidence that the first new compound<sup>k</sup> made should be so efficient and also the least toxic in this series. Several dithiol compounds were subsequently made in Oxford and in Canada<sup>74</sup> and a large number in the USA<sup>71</sup>; none proved less toxic. The LD<sub>50</sub> (dose killing 50 % of a given batch) for rats is about 120 mg./kg.

The behaviour of BAL will now be briefly described. The compound lewisite-BAL is so stable that it gives no nitroprusside reaction. When added to a brain brei before addition of lewisite, BAL protects the pyruvate-system (Table III), in marked contrast to the monothiol compound.

TABLE III. BRAIN PYRUVATE-OXIDASE (BREI) AS TEST-SYSTEM FOR ARSENICAL ANTIDOTES (PROTECTIVE ACTION OF DITHIOLS)

Antidote	Inhibition of O <sub>2</sub> uptake					
	Lewisite			Lewisite + thiol		
	0-30'	30-60'	60-90'	0-30'	30-60'	60-90'
<b>Dithiol compounds</b>						
toluene 3:4-dithiol ...	67	59	59	0	0	0
ethane 1:2-dithiol ...	56	53	50	0	0	0
2:3-dimercaptopropanol	72	46	46	0	0	0
1:3-dimercaptopropanol	45	47	43	0	2	2
1:3-dimercaptopropene	49	52	50	0	0	0
2:3-dimercaptopropyl-amine	45	48	49	0	9	17
kerateine (0.3 %)	65	52	54	10	8	17
<b>Monothiol compounds</b>						
monothioethyleneglycol	57	55	—	54	55	—
cysteine HCl	48	56	—	51	56	45

The thiol was added immediately before the lewisite. The effects in successive respiration-periods are given separately.

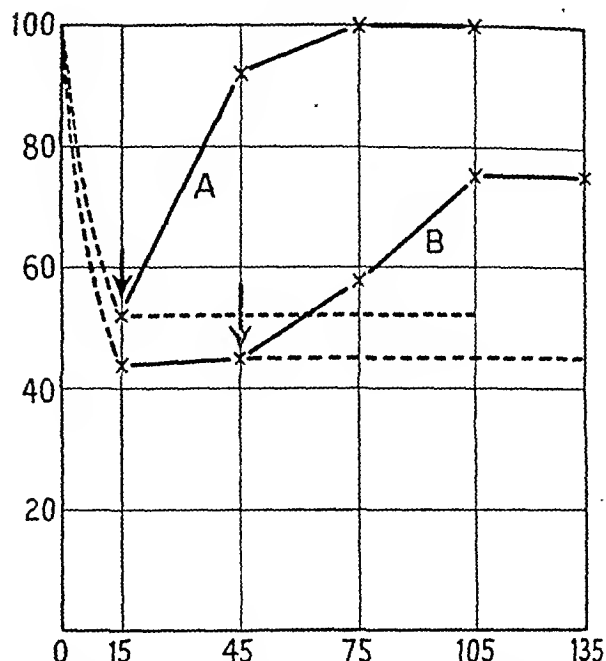
Data of Stocken & Thompson (1946b)<sup>60</sup>

According to the theory outlined in fig. 3, it should also reverse the toxicity when established. Fig. 4 shows that this takes place, and adds the further points of interest that the reversal is not instantaneous and that delay in adding the antidote may lead to some irreversible damage.

Turning now to the effect upon skin in vivo, the photographs (fig. 5-6) show the antidotal action in man. Fig. 5 was taken 2 hours after applications of 1 mm. drops of lewisite at A, B and C. The right arm was treated with antigas ointment after 5 minutes at A, and after 2 hours at C; the left arm was treated with BAL at corresponding times; B was the untreated control. Fig. 6, taken 24 hours after contamination, shows that antigas ointment and BAL were equally effective after 5 minutes, but that after 2 hours only BAL prevented the blister. Indeed at 2 hours after contamination, there is usually erythema and often commencing oedema. The condition is reversed by the antidote and not by a monothiol compound. Remarkable

<sup>k</sup> Independently another preparation of this compound was later published.<sup>75</sup>

FIG. 4. REVERSAL OF TOXICITY TO PYRUVATE OXIDASE



Reversal by BAL of toxicity to the pyruvate-oxidase system induced by addition of sufficient lewisite to give 50 % inhibition of the respiration (approximately 17  $\mu\text{M}$ ). (From data of Stocken & Thompson, 1946b)<sup>60</sup>

↓ : BAL added to system

A : 15' poisoning

B : 45' poisoning

Abscissae: Time (min.)

Ordinates: Respiration (%)

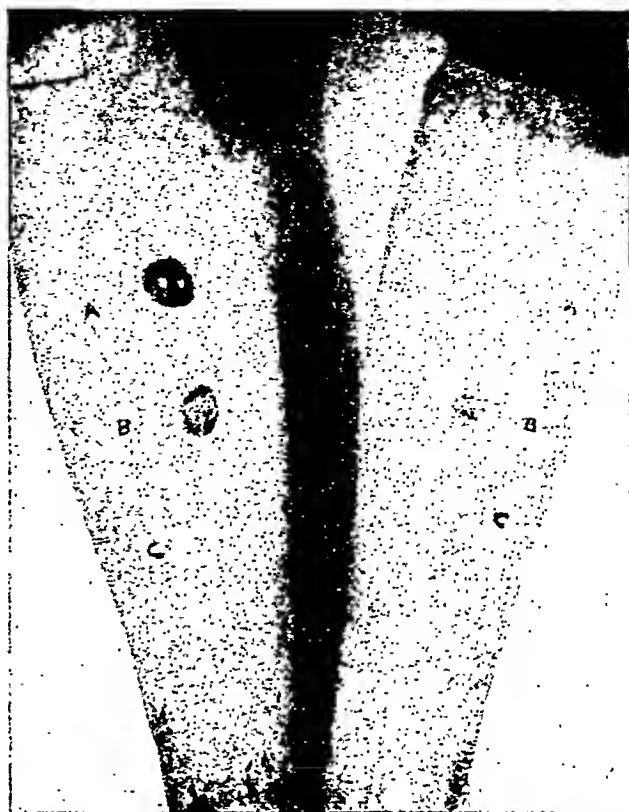
also was the action upon the eyes (Mann & Pirie, 1941)<sup>34, 35</sup>; BAL in a strength of 5-10 % is the only compound able to save an eye when applied up to 10 minutes after contamination with an arsenical. A further "supporting" programme of work showed that, as was hoped, BAL eliminated arsenic from the skin after inunction of lewisite, with an accompanying increased excretion in the urine<sup>61</sup>. When injected into animals poisoned with arsenicals, it could save them even after such signs as diarrhoea had developed. The above experimental work in vitro and in vivo is excellent support for the dithiol theory.

The therapeutic applications of BAL in patients suffering from the accidents of arsenical therapy with therapeutic arsenicals, and from mercurial poisoning, are described elsewhere<sup>1</sup> (Thompson, 1947)<sup>64</sup>, and are a fortunate dividend from the war-research. The exfoliative dermatitis in patients is most probably due to penetration of traces of arsenoxide (otherwise called mapharside) into the skin. Some points about this are interesting. In a brain brei, more mapharside is needed for a given degree of poisoning, and more BAL to reverse the combination<sup>62</sup>; similarly extra BAL is needed to treat mapharside poisoning in vivo<sup>63</sup>; this is interpreted to mean that mapharside-BAL is more dissociated than lewisite-BAL. With mercury there is again a difference; though BAL is more efficient, some monothiols also show some activity.

FIG. 5, 6. PREVENTION OF BURNS DUE TO 1 mm.-DIAMETER DROPS OF LIQUID LEWISITE ON SKIN



FIG. 5. Photo B 6415 taken at time immediately before treatment.



Photographs kindly supplied by the Ministry of Supply

FIG. 6. Photo B 6416 taken 24 hours after test.

- |      |                                                                                               |
|------|-----------------------------------------------------------------------------------------------|
| Area | Right Arm                                                                                     |
| A.   | Treated with antigas ointment 2 hours after contamination, when erythema was well established |
| B.   | No treatment (control)                                                                        |
| C.   | Treated with antigas ointment 2 minutes after application of drop of lewisite                 |

- |  |                                                           |
|--|-----------------------------------------------------------|
|  | Left Arm                                                  |
|  | Treated with BAL 10 % 2 hours after contamination         |
|  | No treatment (control)                                    |
|  | Treated with BAL 10 % 2 minutes after application of drop |

### 3. Further Theoretical Points

The As-dithiol compound in the tissues is slightly more dissociable than the As-BAL, and it seems certain that the ring formed with the protein was larger than one of 5 atoms. Some attempt has been made (Whittaker, 1947)<sup>73</sup> to throw light upon this by comparing the therapeutic efficiency in the brain-test in vitro of dithiols of constitution  $\text{HS}(\text{CH}_2)_n\text{SH}$ , where the number of  $\text{CH}_2$  groups ranged from 2 to 12. The least-successful antidote was 1 : 4-butane dithiol ( $\text{SH}(\text{CH}_2)_4\text{SH}$ ); with this, As would make a ring of 7 atoms, which in the case of other compounds has been considered by organic chemists such as Ruzicka to be a less-stable configuration. It was estimated that the stability of the As-protein in the enzyme lay between that of an eight- and a fourteen-membered ring.

The problem of the toxicity of dithiol upon injection is independently interesting and does not appear to be entirely due to the increase produced in circulating SH groups. Webb & van Heyningen (1947)<sup>72</sup> of Dixon's team found

that BAL markedly inhibited metal-containing enzymes (cf. also Barron, Miller & Meyer, 1947)<sup>6</sup>.

Some two years after the introduction of BAL, a fresh development took place at Cambridge. Danielli & Mitchell, who had been working in Dixon's team upon problems of permeability in relation to the war-gases, with Owen & Shaw<sup>10 m</sup> introduced a BAL-glucoside (BAL-Intrav). This was specifically designed for the systemic treatment of lewisite-poisoning, and to be a highly water-soluble substance, which would remain in the tissue-fluids and not penetrate cells, and would consequently be less toxic. This compound fulfils some of its promise in animals, and it is hoped that further research will make it available for clinical tests. When injected into human subjects, the glucoside increased excretion of copper and zinc in the urine (McCance & Widdowson, 1946)<sup>32</sup>.

Little has been said about the work of others; after the initial work in Oxford and the acceptance of the value of

<sup>m</sup> Of the Imperial College of Science, London.



BAL at Porton, further research developed both there, in Cambridge<sup>15</sup> and at Edinburgh<sup>31</sup>. Some applications have been found in experimental arsine poisoning<sup>19, 30</sup>. Simultaneously, the valuable researches in the USA<sup>71</sup> and in Canada<sup>74</sup> included much work upon the essential problems of the composition of ointments, the pharmacology of BAL, and other therapeutic developments.

#### 4. General Implications

It is satisfactory that these researches carried out originally for a war-objective have repercussions in branches of science related to biochemistry. For pathology it is believed to be the first instance in which commencing damage in tissues can be reversed by a logical chemical step. We now have evidence that biochemical lesions in the oxidation stage of pyruvate can be due either to a vitamin-deficiency or to positive exposure to a toxic agent; in this sense the "enzyme" theory has grown up, though the writer would not suggest that this is the only mode of inducing cell-damage. Doubtless further research will show the importance of other enzymes along these lines; meanwhile, it can be noted that there is an especial delicacy about pyruvate oxidation, because it has been claimed that the same enzyme is also damaged in oxygen-poisoning<sup>4, 12, 57, 18, 35</sup> and in narcosis<sup>51</sup>.

Some pharmacological aspects of arsenic problems are now much more clear; but, in view of the complications of biology as well as of the chemistry of arsenic, it would not be suggested that all problems in the field of arsenical toxicity and arsenotherapy are now solved<sup>7</sup>. Many of the difficulties to be met in the application of Ehrlich's chemoreceptor theories have been well presented earlier (Dale, 1923)<sup>9</sup> and are still real today; there may be mentioned as an example the selectivity of the arsenical for the protozoal tissue. Nevertheless, the application of chemistry to the cell must always be revealing when based upon a proper physiology; Ehrlich's determination (1909)<sup>17</sup> to apply chemistry boldly to the cell is highly stimulating, when given a modern dress; his suggestion that the arsenoreceptor might be hydroxyl (to which he gave most stress) or sulphhydryl (based upon Heffter) is interesting, though not based upon experiment. When Voegtlin (1925)<sup>67</sup> later advanced the sulphhydryl group as receptor, this was based upon their work with thiol substances and arsenoxide. It is a fundamental advance upon this to be able to indicate the enzyme-protein constituent attacked and the mode of attack. Short of direct evidence by isolation, it is virtually

proven that the enzyme compound has an essential thiol group, and that with primary trivalent arsenicals the thiol groups are sufficiently contiguous to allow of ring formation.

During the last decade, a tribute to the inspiration of Hopkins, much work has been done upon SH enzymes<sup>28, 14, 24, 7</sup> as well as upon SH groups in other proteins<sup>66, 36</sup>; such SH enzymes require an SH group for activity. It has been learnt that such groups are not all equally activated for various inhibitors; for instance, triose-phosphate dehydrogenase is much more sensitive to iodoacetate than is succinodehydrogenase<sup>13</sup>. Hence there are possibilities of variation in activation as well as in spatial relation. Biochemical analysis has shown wide variations also for various trivalent arsenical compounds in the toxic inhibitions of different enzymes<sup>23, 5</sup> and their response to thiols; many instances of reactivation by monothiols were found. Dixon<sup>15</sup> and his Cambridge team during the war developed the theory that vesicants attack hexokinase, the enzyme responsible for the first stage in glucose-degradation; this was based mainly upon an interesting correlation in the toxicity of various vesicants and hexokinase inhibition. To this, lewisite must be an exception; though it poisons hexokinase, the inhibition in vitro is reversed by a monothiol, whereas in vivo (as for pyruvate oxidase) a "dithiol" is necessary<sup>9</sup>. Presumably in cases where the toxicity of an arsenical can be reversed by a monothiol, circulating glutathione will act as a natural antidote.

During the war, independently, in Belgium, Bacq (1946, 1947)<sup>12</sup> became interested in the relation between toxicity of chemical-warfare substances and their behaviour with SH groups; lately he has introduced the term "thioloprive substances". This generalization is useful, though it will be realized that the final detail of the biochemical action will vary.

In conclusion, it is the writer's opinion that the discovery of lewisite was of real significance for this progress, because the compounds formed with it are so non-dissociable that attention was diverted from monothiols. In this sense, it is particularly appropriate to point out how closely Britain and the USA have been associated in these developments. In fact this war-research as a whole, in its course and publication, in addition to its scientific interest, has set a shining example of the excellent standards which can be reached in international co-operation.

I wish to thank Miss J. Allen for secretarial assistance, Prof. R. H. S. Thompson for reading the MS and Dr. L. A. Stocken for help with diagrams.

<sup>9</sup> The dithiol theory applies only to arsenical action; whether 2 SH groups are needed for the activity of one enzyme molecule is a different problem.

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## THERAPEUTIC APPLICATIONS OF BRITISH ANTI-LEWISITE

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- 1 Arsenical vesicants
- 2 Arsenical dermatitis
  - a. Dermatitis due to diphenylamine chloroarsine (phenarsazine chloride)
  - b. Exfoliative dermatitis
  - c. Arsenical hyperkeratosis
- 3 Arsenical encephalopathy
- 4 Arsenical granulocytopenia
- 5 Mercurial poisoning
- 6 Gold dermatitis
- 7 Other metal-intoxications

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In the production of specific antidotes against the action of toxic agents inside the animal body, one of the main

objectives is to dissociate the toxic substance from the "tissue acceptor" with which it has combined, and to convert it by chemical reaction with the antidote into some stable derivative of lower toxicity, capable of excretion from the body.

As early as 1909 Ehrlich suggested on theoretical grounds that the "chemo-receptors" for arsenic in living cells might be hydroxyl or thiol groups, reaction with which would cause the metabolic disturbance characteristic of the toxic effect, and shortly after the 1914-18 war independent experimental evidence in support of this view began to accumulate (for a review of this work see Peters, 1947). Despite this knowledge, fundamental to a rational solution of the problem, no satisfactory specific therapy of arsenical intoxication had been evolved, although a number of different thiol compounds had been investigated in the hope that they might compete effectively with the tissue-thiols for the arsenic.

### I. Arsenical Vesicants

At the outbreak of the recent war, however, research into the production of arsenical antidotes was actively resumed in this laboratory, chiefly in respect of lewisite and the other arsenical vesicant "gases", and by 1941 an antidote that fulfilled many of the desired theoretical criteria had been produced (Peters, Stocken & Thompson, 1945). This compound was 2:3-dimercaptopropanol, subsequently called British Anti-Lewisite (BAL). Until the introduction of this substance the study of potential thiol antidotes

## DEVELOPMENT OF BAL

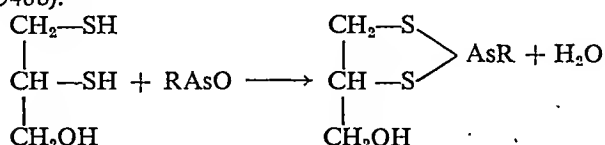
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against arsenic had been limited to the use of monothiol compounds. Towards the end of 1940, however, Stocken & Thompson, in the course of a quantitative study of the action of lewisite on the SH-protein keratine, isolated and analyzed the lewisite-protein compound, and showed that about 75 % of the arsenic contained in this derivative had combined in the ratio 1 As : 2 SH. This finding suggested at once the possibility that dithiol compounds might prove more effective than monothiols in antagonizing lewisite, a suggestion which was subsequently fully confirmed in animal and human experiments, no monothiol having yet been found which can prevent vesication by lewisite in man. 2:3-Dimercaptopropanol was synthesized and found to be the most suitable of a large number of dithiols prepared both in Britain and the USA.

This compound reacts with arsenoxides to give a five-membered-ring compound more stable than that formed between the arsenical and the "tissue-acceptor", and very much more stable than the compound formed between arsenicals and monothiols (Stocken & Thompson, 1946a, 1946b).



BAL is a colourless oil, approximately 6 % soluble in water at room-temperature; it is stable in the pure state, or when dissolved in non-aqueous media, but is rapidly oxidized in aqueous solution near the neutral point. Laboratory animals contaminated or injected with lethal amounts of lewisite can be effectively treated by the use of BAL applied either on the skin or by injection, a significant increase in the urinary excretion of arsenic resulting (Stocken & Thompson, 1946c). The blistering effect of lewisite on human skin can be prevented by the local application of BAL to the affected area as late as 1½ hours after contamination. This fact in itself provides evidence of the ability of BAL to reverse the toxic action of lewisite, since its application to the contaminated area can be delayed until after intense erythema has appeared; instead of progressing to the usual tense vesicle overlying an area of necrosis, the erythema in most cases disappears almost completely within 24 hours of the treatment.

Apart from these experimental results, BAL was used successfully during the war years for the treatment of accidental splashes of arsenical vesicants on the skin of factory-workers. Cases of accidental contamination of human eyes with arsenical vesicants were fortunately few, but the reports received indicated that those treated with BAL supported the general results of animal experiments, in which it had been found that the instillation into the conjunctival sac of a 5 % or 10 % solution of BAL within 5 minutes of contamination resulted in almost complete recovery.

The importance of determining the efficacy of BAL against the toxic effects of the therapeutic arsenicals was early realized, and in 1942 work was begun with this end in view both in Britain and the USA. In Oxford, Stocken, Thompson & Whittaker (1947) showed that BAL can protect the pyruvate-oxidase enzyme-system of brain against mapharside, neoarsphenamine and arsphenamine, and is

also effective in maintaining the survival of rats after the injection of lethal doses of mapharside or neoarsphenamine. In America, Eagle in 1943 demonstrated that BAL can resuscitate micro-organisms poisoned by mapharside, and is also of value in the treatment of acute or subacute mapharside poisoning in rabbits (Eagle, Magnuson & Fleischman, 1946); in the course of this work these investigators found that solutions of BAL in arachis oil containing benzyl benzoate could be sterilized by heat with only slight loss in activity.

Before this finding, work had been started on the treatment of arsenical dermatitis in man by the inunction of BAL ointments (Longcope, Luetscher, Wintrobe & Jager, 1946; Carleton, Peters, Stocken, Thompson, Williams, Storey, Levvy & Chance, 1946), but although distinctly encouraging results had been obtained, the irritant action of BAL on human skin, more pronounced on skin already inflamed, indicated that inunction was not an entirely satisfactory method of administration. Eagle's finding therefore was an important advance, since ampoules of the compound suitable for intramuscular injection into man could be readily prepared. In Britain, the ampoules finally used, prepared by a modification of Eagle's method, contained 5 % BAL in arachis oil and benzyl benzoate, the ampoules being nitrogen-filled and sterilized by heating for 1 hour at 170°C.

The treatment of a number of different metal-intoxications with BAL has now been investigated, and will be considered under the following headings.

## 2. Arsenical Dermatitis

### a. Dermatitis due to diphenylamine chloroarsine (phenarsazine chloride)

The first application of BAL to the treatment of widespread arsenical lesions in man was carried out by Longcope, Luetscher, Wintrobe & Jager (1946) in 7 cases of dermatitis occurring in workers exposed to the dust of diphenylamine chloroarsine (also known as DM). The lesions involved the exposed areas of the face, neck and arms, and had proved intractable to the standard forms of treatment, having been present, in 6 of the patients, for from 18 to 50 days before admission to hospital. Treatment with daily applications of BAL ointment caused the dermatitis to clear completely in from 2 to 8 days, with an average of a little over 5 days. In the course of this work it was shown that successful results could be obtained by inunction of the ointment into areas of normal skin, the BAL, after absorption, bringing about detoxication in the affected areas; by this means it was possible to avoid the intense burning sensation produced by the application of BAL to erythematous skin.

### b. Exfoliative dermatitis

Considerable experience has now been accumulated in the treatment of exfoliative dermatitis occurring as a complication of arsenotherapy. In a first series of 30 patients Carleton *et al.* (1946) have reported a beneficial effect in approximately 50 % of cases; 21 of these were treated by intramuscular injection, and the remainder by inunction.

In a more recent report (Carleton, Peters & Thompson, 1948) the results obtained in a further 44 cases have been described. Of these cases 41 were of the acute exfoliative type, and the dermatitis was in all cases severe and wide-

spread. The BAL was given by deep intramuscular injection into the gluteal region, the following course of injections being given in most cases :

First day : 4 injections of 2 ml. 5 % BAL at 4-hourly intervals ;

2nd, 3rd and 4th days : 2 ml. twice daily ;

5th and 6th days : 2 ml. daily.

From the reports received from the clinicians who co-operated in this trial, it has been concluded that a "good" response was obtained in 23 cases (52 %), while if 8 further cases in which a "fair" response was obtained are included, the number of those benefited by the treatment is 31 (70 %). In some cases an almost dramatic response was obtained, and the mean duration from the first injection of BAL to healing or nearly complete healing was 21 days. Photographs of one of the cases described in that report are given in fig. 1 and 2.

In America, Longcope *et al.* (1946) have described 15 cases of generalized exfoliative dermatitis following the use of anti-syphilitic arsenical drugs, and have stated that symptomatic and objective improvement regularly followed the administration of BAL. Luetscher, Eagle, Longcope & Watson (1946) have, in addition, followed the arsenical excretion in 16 cases and have shown that, in a proportion, BAL-therapy causes an increased elimination of arsenic in the urine. Carleton *et al.* (1946) also studied the urinary arsenic-level in a number of cases, but were unable to detect any significant increase following treatment with BAL. The absolute amounts of arsenic appearing in the urine are, however, small, and owing to the variations in the day-to-day excretion and to the long intervals which in some cases elapsed between the last injection of arsenic and the beginning of treatment, this result is not surprising.

The American workers, however, have used 10 % solutions of BAL and in severe cases have given a higher dosage than that used in Britain.

In several instances, clinical evidence of relapse has been obtained shortly after the end of BAL therapy. This has in every case responded satisfactorily to a further short course of injections.

#### *c. Arsenical hyperkeratosis*

An account of one case of arsenical hyperkeratosis of the palms and soles, together with marked pigmentation of the lower trunk and thighs, has also been received. This patient was given 2 courses of BAL therapy at an interval of a month. It was concluded that a definite reduction of the keratosis occurred in response to the treatment, accompanied by an almost complete disappearance of pigmentation. Although this is the only report of such a case, it is of interest in view of the chronic nature of this type of lesion.

### 3. Arsenical Encephalopathy

In a report of the Council on Pharmacy and Chemistry of the American Medical Association (1946) a brief account is given of the use of BAL in the treatment of 55 cases of "haemorrhagic encephalitis" caused by intensive arsenotherapy. Eleven deaths occurred in this series, but the remaining 44 patients recovered completely in 1 to 7 days. In 5 of the 11 fatal cases BAL was not injected until from 9 to 72 hours after the onset of convulsions or coma.

In Britain, BAL has been given in 3 cases. In 2 of these complete recovery took place in less than 1 week, while in the third, consciousness was recovered on the fourth day and an uninterrupted recovery with no residual sequelae followed.

### 4. Arsenical Granulocytopenia

Although the number of cases so far studied is small, BAL also appears to be of value in the treatment of granulocytopenia occurring during arsenotherapy. A favourable response in the leucocyte-count, with a proportionately greater increase in the number of polymorphonuclear leucocytes, occurred in 10 of 11 cases reported in the USA (Council on Pharmacy and Chemistry, 1946). Five cases have also been treated with BAL in Britain ; in each case a rapid restoration of the leucocyte-count occurred.

### 5. Mercurial Poisoning

Preliminary work on enzyme-systems and on laboratory-animals (Gilman, Allen, Phillips & St. John, 1946 ; Thompson & Whittaker, 1947 ; Stocken, 1947) has shown that BAL can also detoxicate mercury. An interesting series of 23 cases of acute poisoning by mercuric chloride in man, treated with intramuscular injections of BAL, has been described by Longcope & Luetscher (1946). The amounts of mercury swallowed by these patients varied from 0.5 to 20 g. of mercuric chloride. 22 of the 23 patients recovered completely, the one death being in a patient who was not treated with BAL until 13 hours after taking the mercury.

### 6. Gold Dermatitis

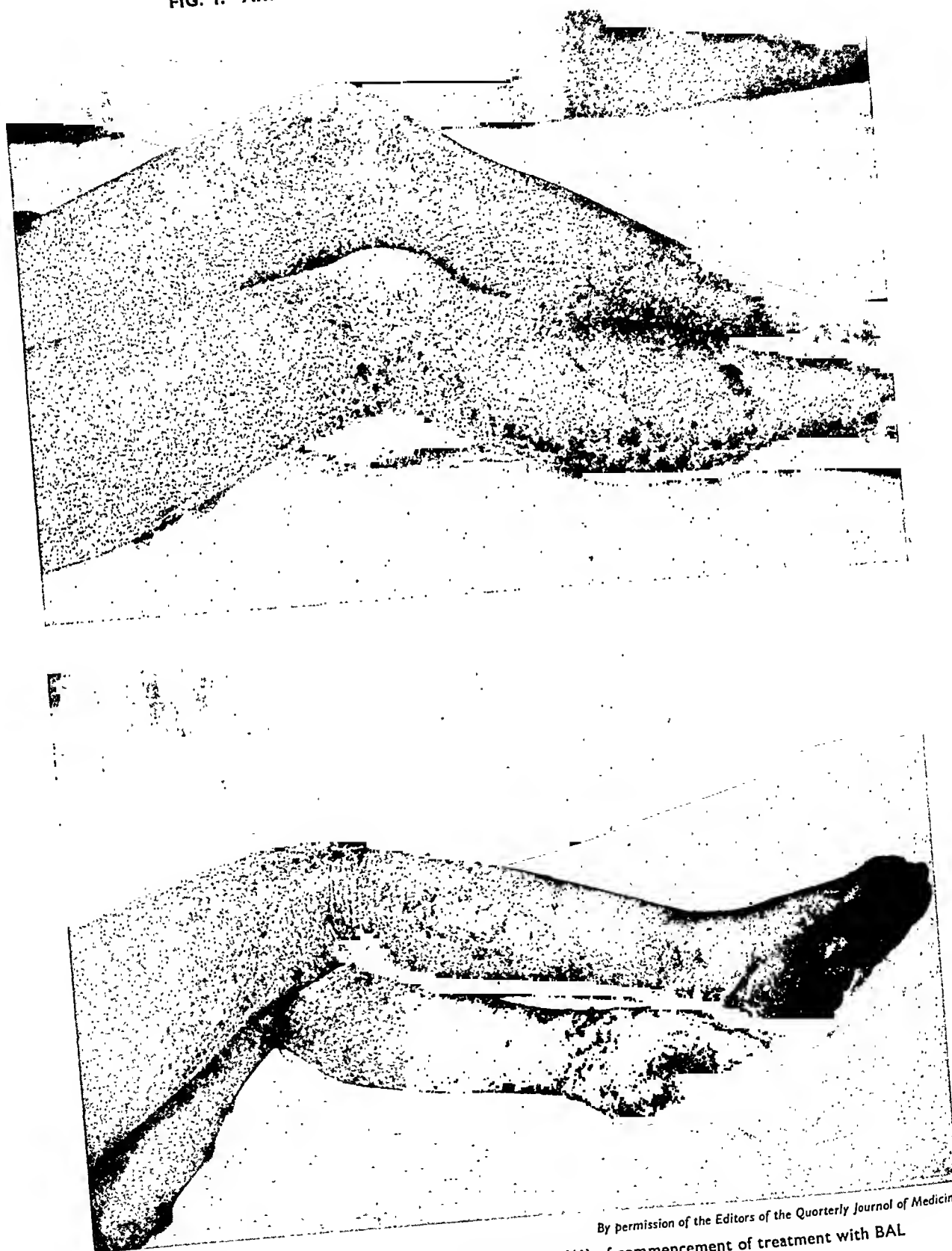
In 1945, experiments with the pyruvate-oxidase system of brain (Thompson & Whittaker, 1947) indicated that BAL might be of value in the therapy of gold-intoxication, and clinical reports have now appeared supporting this view. Cohen, Goldman & Dubbs (1947) and Ragan & Boots (1947) have described beneficial effects in the treatment of gold dermatitis, and the latter workers have also claimed that a significant increase in the excretion of gold in the urine accompanied the treatment. A few cases have also been studied in Britain with encouraging results.

Lockie, Norcross & George (1947) have also reported a case of thrombocytopenic purpura and another of granulocytopenia due to gold, both of which responded promptly to treatment with BAL.

### 7. Other Metal-Intoxications

Studies of therapeutic possibilities in connexion with other metals are still in an early stage. Barron & Kalnitsky (1947), using the succinoxidase enzyme-system, have shown that BAL and certain derivatives of BAL are effective in protecting this enzyme from the toxic effects of a number of metals including lead, antimony, bismuth, cadmium and zinc. Braun, Lusky & Calvery (1946) have examined the effectiveness of BAL in a number of different metal-intoxications in rabbits. It appears to be an effective antidote in acute poisoning caused by antimony, bismuth, chromium, nickel and mercury, but is ineffective against lead, thallium and selenium ; in the case of lead and selenium, indeed, BAL appeared to produce an additive toxicity. Its use in experimental cadmium-poisoning has

FIG. 1. ARSENICAL DERMATITIS BEFORE TREATMENT

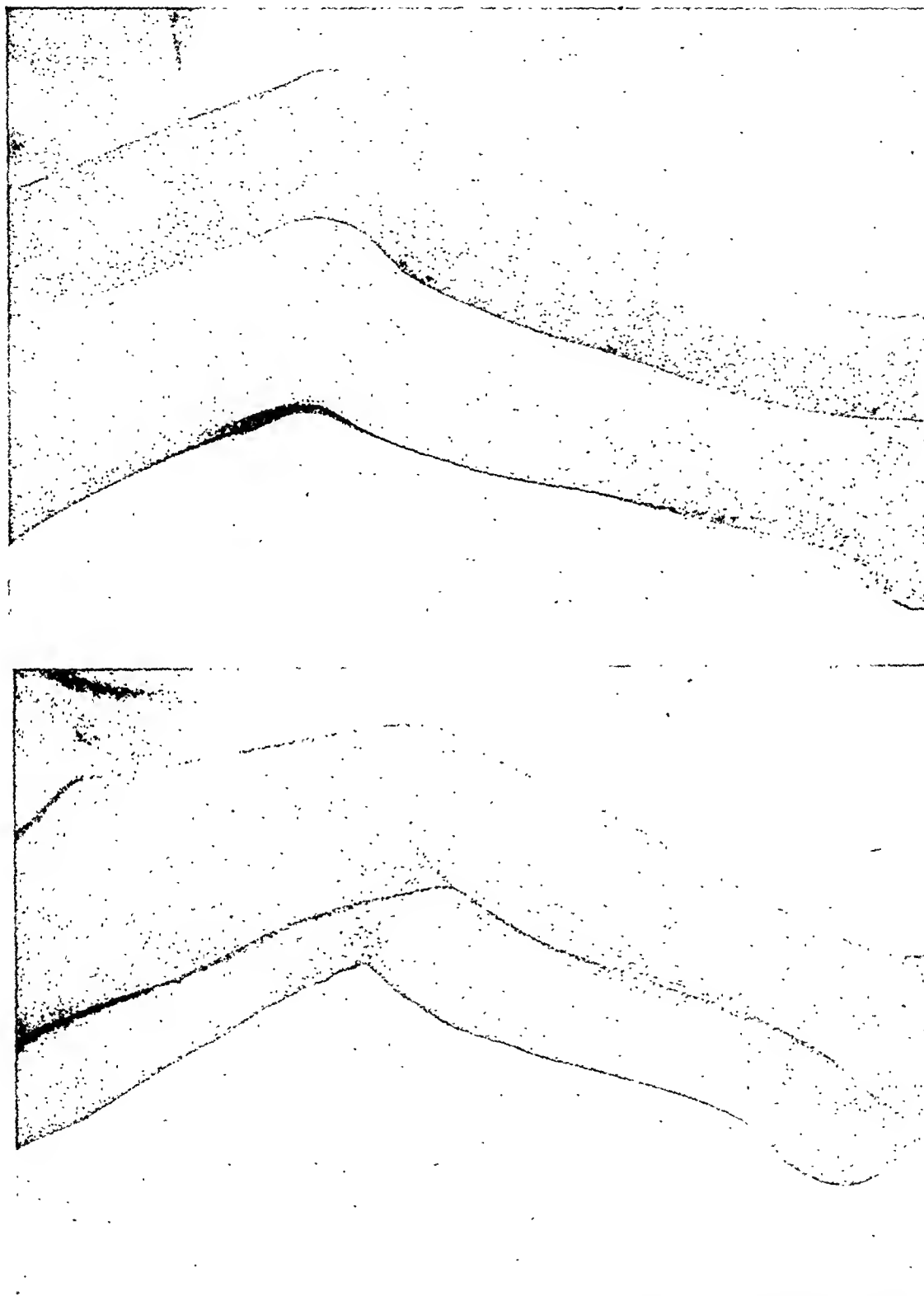


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The photographs show the condition on the day (14/6/46) of commencement of treatment with BAL



FIG. 2. ARSENICAL DERMATITIS AFTER TREATMENT WITH BAL



*By permission of the Editors of the Quarterly Journal of Medicine*

The photographs show the same case as in fig. 1, 14 days later

been studied extensively, but although it has proved of value in protecting animals from the systemic effects of this metal, it appeared to form toxic complexes with the cadmium which gave rise to serious renal damage (Gilman, Philips, Allen & Koelle, 1946; Tobias, Lushbaugh, Patt, Postel, Swift & Gerard, 1946).

The toxicity of BAL to man has been the subject of careful study in America (Sulzberger, Baer & Kanof, 1946; Modell, Gold & McKen Cattell, 1946). In brief, it has been shown that the minimal dose given by intramuscular injection which causes toxic reactions in man lies between 3 and 5 mg./kg. Single doses of up to 8 mg./kg. have been given, and even at this level the toxic manifestations are completely reversible, lasting only about an hour or two. Apart from subjective phenomena, lachrymation, salivation, vomiting and an elevation of both systolic and diastolic blood-pressure occurred with these higher doses. It should be pointed out again that the therapeutic dose used in Britain is only about 1.5 mg./kg. bodyweight.

In Britain, Cameron, Burgess & Trenwith (1947) have studied the toxicity of BAL to rabbits with experimentally-

induced renal and hepatic damage. No evidence was obtained of any increased toxicity in animals with renal damage, except when renal failure was complete or nearly complete, when a slight lowering of tolerance to BAL was observed. Evidence of increased toxic effects was, however, present in animals with hepatic damage, suggesting that care should be exercised in the administration of BAL to patients with impaired liver-function.

An important water-soluble derivative of BAL, BAL-Intrav, has also been prepared in Britain (Danielli, Danielli, Mitchell, Owen & Shaw, 1946). It is a glucoside of BAL, and is of strikingly low toxicity. It has been shown to be of distinct value in the treatment of animals poisoned with large doses of lewisite, but, except for experimental purposes, has not yet been obtained in a form suitable for injection into man.

#### ACKNOWLEDGEMENTS

My thanks are due to Dr. T. E. Anderson for permission to mention his case of arsenical hyperkeratosis, and to Dr. A. B. Carleton for the photographs of her case of exfoliative dermatitis in the Radcliffe Infirmary, Oxford.

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## HUMAN BIOCHEMICAL GENETICS

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- 1 Methods of biochemical genetics
  - 2 Difficulties and advantages of man as a subject for chemical genetics
  - 3 Prospects of human chemical genetics
  - 4 Non-genetic heredity
  - 5 Future progress
- References

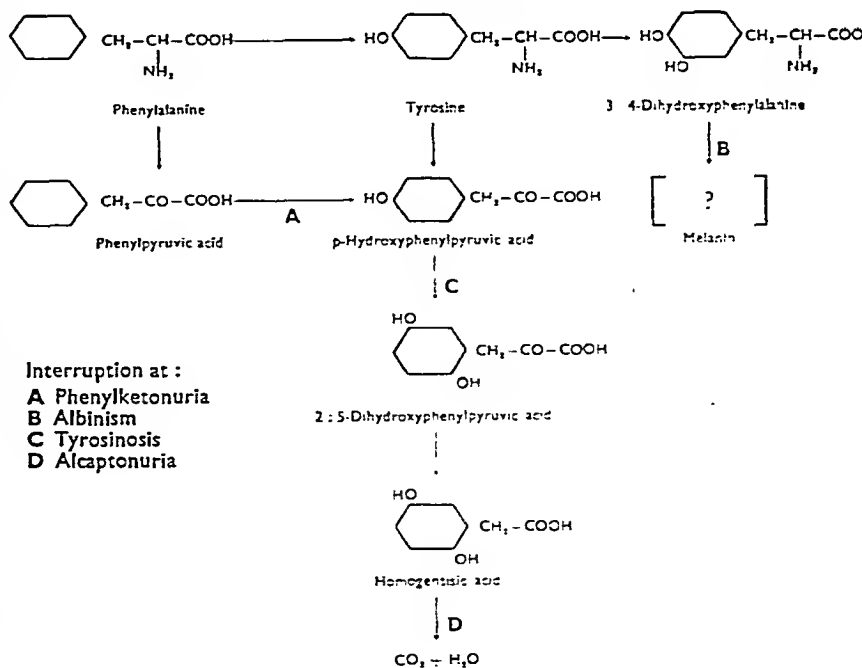
The study of biochemical reactions influenced in vivo by genes, or conversely the study of genes that control biochemical processes in vivo, is the subject-matter of biochemical genetics. Since the general acceptance of Mendel's principles after their rediscovery in 1900, it has seemed likely that many genes exert their influence by affecting the course of chemical reactions in the organism. This influence may be direct or indirect. The primary action of a particular gene may be concerned, for example, with the synthesis of a coenzyme. A mutation of this gene to an inactive form, followed by the production of an organism homozygous for it, would result in an organism in which a number of reactions dependent on coenzyme would now be impossible and in the organism being viable only in the presence of external sources of coenzyme. Thus, it might appear that mutation of a single gene was responsible for the failure of several reactions (secondary effects), though the immediate effect is the failure of one reaction only (primary effect). It may be argued that the chain of events could be followed further back—that the mutation might be responsible for failure to synthesize not a coenzyme, but an enzyme responsible for coenzyme-synthesis, or even an enzyme-precursor of the enzyme responsible for coenzyme-synthesis. At present, however, it can be said that some genes have definite effects, among which can sometimes be found a primary effect that is connected with a definite biochemical reaction. The hypothesis that genes act by means of their control of biochemical reactions, that there is a "one gene, one reaction" relation, and that where a gene appears to have other effects (such as psychical or morphological) these will be found to be consequent on biochemical effects, seems likely to be a fruitful stimulus to further work.

The first demonstration that such gene-controlled reactions occur was made by Garrod in his pioneering work *Inborn errors of metabolism* (1909). Garrod discussed fully the biochemical and genetic

aspects of alcaptonuria and laid the foundations of the study of biochemical genetics. In 1914, Gross discovered an enzyme present in the serum of normal individuals, and absent from the sera of alcaptonurics, capable of catalyzing the oxidation of homo-gentisic acid. This enabled Garrod, in the second edition of his book in 1923, to complete the demonstration that alcaptonuria was due to the absence of a gene responsible for producing an enzyme catalyzing a relatively-simple biochemical reaction; but his work was almost completely ignored by geneticists until its significance was emphasized in recent years, notably by Haldane.

Since that time, only one other chemical reaction controlled genetically, in which *both initial and final products* of the reaction are of known composition, has been discovered in man. In this, the absence or inactivity of the gene results in the appearance of phenylpyruvic acid in the urine. This condition, discovered by Folling in 1934, was subsequently thoroughly investigated in Britain by Penrose (Penrose, 1935; Penrose & Quastel, 1937). Like alcaptonuria, the condition is inherited as a recessive character, and appears to be due to the absence in affected subjects of a gene controlling, in some way, the ability to oxidize phenylpyruvic acid to *p*-hydroxyphenylpyruvic acid. A single case of a related biochemical disability has been noted in a subject unable to oxidize the latter compound to the 2:5-dihydroxy compound (Medes, 1932). Since only one case has been studied, it has not been possible to show that this condition, too, is inherited as a recessive, though there is every reason to believe that it is. A summary of these genetically-controlled disabilities in the oxidation of phenylalanine and related compounds is reproduced as fig. 1 (after Haldane, 1941). Other hereditary peculiarities of metabolism in man that appear likely to have a relatively-simple

FIG. 1. PHENYLALANINE-TYROSINE METABOLISM IN MAN (BASED ON HALDANE, 1941)



biochemical cause of the type responsible for alcaptonuria and phenylketonuria, are congenital steatorrhea, pentosuria, cystinuria and haematoporphyrin.

Hair- and skin-colour in man is due to the presence or absence of melanins. The melanins are complex substances whose composition is obscure, and their study is made more difficult by the facts that they are insoluble and the degree of physical dispersion may cause variations in their colour, though not necessarily in their composition. The inheritance of coat-colour in the guinea-pig has been intensively studied by Wright (1941), who has shown that at least seven genes are involved, some of which are concerned with pigment-synthesis and some with follicle-differentiation. Non-genic agents may also be involved (Billingham & Medawar, 1947). Owing to the number of genes involved, and the complex nature of their end-products and interactions, it seems unlikely that an understanding of the inheritance of pigmentation, and the characterization of the reactions involved, will soon be achieved for man.

### 1. Methods of Biochemical Genetics

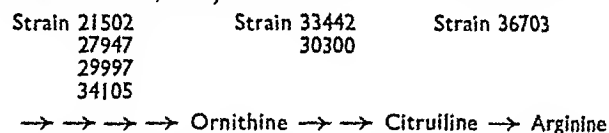
Until recently, biochemical genetics has been concerned with defects of metabolism that are not usually of prime importance to the organism. That this is so, follows from the fact that only those defects are open to observation which are not sufficiently serious to kill the subject before its metabolism can be examined. A further limitation is imposed by the fact that the vast majority of mutations are recessive, and are therefore usually masked by the presence of a dominant allele whose influence can be eliminated only by breeding-experiments. Much fruitful recent work has been rendered possible by avoiding this difficulty by the use of organisms that can be investigated in the haploid stage. Among such organisms are some yeasts and moulds, *Saccharomyces* and *Neurospora* in particular. These organisms have the further advantage that the generation-time is short—6 days for *Saccharomyces*. The advantage of a short generation-time was of course realized early, and accounts largely for the intensive use of the fruit-fly *Drosophila* (generation 10 days) in genetical studies. Although bacteria, which have a short generation-time and are well suited to biochemical study, undergo changes apparently similar to mutation in higher organisms, they are not susceptible to genetical study as their reproduction is vegetative.

Although genically-controlled biochemical disabilities which would be lethal to the organism cannot be studied in most subjects, *Neurospora* has been used in this way (Beadle, 1945a). *Neurospora* is a mould that will normally grow well on a very simple medium containing only salts (including a nitrogen-source), an energy-source, such as a suitable fat or carbohydrate, and the vitamin biotin. Irradiation of *Neurospora* peritheca prior to reduction-division results in the production of ascospores which may contain mutant genes. On germination, these ascospores form a haploid mycelium which should show the effect of any mutations produced. Some of these mutations will be such that the organism is no longer able to synthesize all the compounds normally required in its metabolism. Such a spore would not therefore be capable of growth on a simple medium, and the mutation could be classed as lethal. If, however, the spores are allowed to germinate on a medium

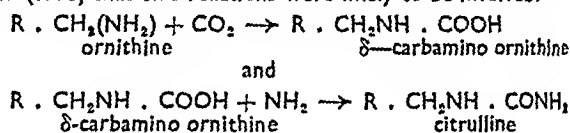
containing as many substances, likely to be of importance in the mould's metabolism, as the investigator can supply, growth may occur. If transfer to the simple medium shows that such a mutation has occurred, the use of the medium supplemented singly with known compounds will reveal the particular failure in synthetic ability that has been induced. An examination of the mutants obtained in this way has added a great deal to our knowledge of chemical genetics. It has been shown, for example, that no less than 7 genes are concerned in the synthesis of the amino-acid arginine by *Neurospora* (Srb & Horowitz, 1944). Further analysis of these mutants has rendered it likely that each of these genes is concerned with a single stage of the synthesis (fig. 2).

### FIG. 2. ARGININE SYNTHESIS IN NEUROSPORA

Genes controlling steps in this scheme are identified by the numbers of the mutant strains in which they were first found (Srb & Horowitz, 1944).



NOTE: That two reactions were concerned in the transformation of ornithine to citrulline was suggested by Srb & Horowitz because two genes were necessary. It had been suggested earlier by Krebs (1936) that two reactions were likely to be involved:



Work on the biochemical genetics of *Saccharomyces* is of considerable theoretical importance, in that it has shown that changes in a gene may be obscured by cytoplasmic effects. A diploid yeast, heterozygous for the gene controlling the formation of an enzyme responsible for ability to ferment the sugar melibiose, will produce under normal circumstances four haploid ascospores of which only two will be capable of melibiose-fermentation on germination, owing to the segregation of the gene responsible. If, however, melibiose is present throughout copulation and ascospore-formation, the cultures derived from the four ascospores will all be able to ferment melibiose. Segregation of the gene responsible has occurred in the normal manner, however, for it can be shown that two of the cultures will lose permanently the ability to ferment melibiose if grown in its absence, while the other two do not. Thus, it must be concluded that the enzyme responsible, or a precursor, is capable of self-reproduction as long as its substrate is present. It is possible that, if this mechanism is shown to be of wide occurrence, it may prove that some enzymes acting on substrates invariably present in cells may no longer be produced under genic control, but may be perpetuated by a cytoplasmic mechanism.

As a result of work on haploid organism, no less than 9 of the total 25 genically-controlled reactions listed in the recent review by Beadle (1945b) have been discovered, and another 4 are accounted for by the work of Moewus on sex phenomena in *Chlamydomonas*. Thus, rather more than half the data of chemical genetics derives from the study of micro-organisms.

After micro-organisms, the most fruitful type of material quantitatively has been the higher plants, which account for a further seven reactions. These include those responsible for anthocyanin synthesis, glucoside hydrolysis, and a carotinoid transformation, and are not of great interest for the present purpose, though adding to the evidence that each step in a synthesis may be controlled by a single gene. A reaction involving an oxidation of tryptophan in insects, the hydrolysis of atropine in the rabbit, and the formation of allantoin from uric acid in dogs, completes the list of known reactions, with the addition of the two already described for man.

A consideration of the results so far described gives reason to believe that many of the metabolic processes of man will be found to be under genic control. The accumulation of knowledge related to metabolism in man may enable some conditions, found to be due to abnormal metabolism, to be controlled by supplying substances that cannot be synthesized, or by excluding from the diet substances whose abnormal metabolism may lead to disease. It may be argued that vitamin therapy is an example of this method, for there is no sharp distinction between the treatment of a *Neurospora*-mutant incapable of synthesizing thiamin, by supplying it in the culture-medium, and treating scurvy in man by ascorbic acid, which other mammals can synthesize, though man cannot.

## 2. Difficulties and Advantages of Man as a Subject for Chemical Genetics

The difficulties inherent in the study of the genetics of man have been summarized by Crew (1946), who points out that a

species which lives in an environment created by itself, and which is notable for its variety, must present considerable difficulties when the species itself reproduces so slowly, has so few offspring, fails to maintain pedigrees, and cannot be used as experimental material.

There are, however, advantages in the study of man. The population available for study is large, and the presence of abnormality of any kind in a large part of it is likely to be brought to the attention of medical men and through them to that of geneticists. The study of human genetics also widens the range of data available, since the subject can describe reactions to stimuli that would otherwise be hard to determine. It is a simple matter to examine human beings for colour-blindness, more difficult and time-consuming for bees or birds. The study of mental symptoms which may occur as end-effects of simple failures of metabolism (imbecility in phenylketonuria) is not only of great practical importance but almost impossible in other experimental material.

## 3. Prospects of Human Chemical Genetics

The possible applications of a fuller knowledge of biochemical genetics of man may be divided into :

- i. Avoidance of the full expression of deleterious genes.
- ii. Avoidance of deleterious consequences of gene-action.
- iii. The suppression of undesirable genes.

Many genes give rise, not to the invariable manifestation

of a character, but to a predisposition to a character that may be exhibited only after some stimulus, presumably environmental in origin. The absence of sweat-glands, for example, may not be noticed in the British climate, but transfer to the tropics makes it obvious. In other examples, the exciting factor that may cause the exhibition of symptoms of conditions hitherto latent is not known. Epileptics show a characteristic wave-pattern in electroencephalograms, and similar patterns occur in non-epileptic subjects who may be supposed to have inherited epileptic tendencies. Only about one in twenty of subjects with the epileptiform electroencephalogram is an epileptic, and present evidence indicates that the predisposition is inherited as a simple Mendelian dominant (Lennox, Gibbs & Gibbs, 1939). Further research may succeed in identifying the evocative conditions, and enable them to be avoided by those disposed to epilepsy.

Even if the action of a gene cannot be avoided, its ill effects may be circumvented. The occurrence of blood-group antigens is genically-controlled in man, and among them the rhesus series is of importance in the study of haemolytic disease of the newborn (Race, 1946).<sup>1</sup> While no example is known of antibodies to rhesus antigens occurring spontaneously, they are readily formed in response to immunization. This immunization may be due either to transfusion of blood containing rhesus antigens not present in the recipient's blood, or to the introduction of such antigens from the foetus into the circulation of the mother. The maternal rhesus antibodies formed in response to this iso-immunization may travel across the placenta, causing haemolysis in the foetus. Haemolytic disease of the newborn in those cases (the majority) due to the rhesus incompatibility between mother and child is, of course, determined genically, since the occurrence of the antigens responsible is genically determined. It is, however, another example of a condition that is shown in only a small number of the cases in which it might be expected. About one pregnancy in ten is such that the necessary antigen-distribution between mother and child is present, yet evidence of maternal antibody-formation is obtained in only about one in 250 pregnancies. It has been shown that some of those cases of haemolytic disease of the newborn not explicable on the basis of rhesus incompatibility may be due to incompatibility of the ABO groups—a condition hitherto unnoticed owing to the great rarity of the response in conditions apparently favourable (Aubert, Cochran & Ellis, 1945).

When haemolytic disease of the newborn does occur, it may vary in severity. Effects range from jaundice to kernicterus and hydrops foetalis. When the effects are limited to jaundice, cure is possible by transfusion of blood not haemolyzed by the antibodies present in the infant's plasma. Haemolytic disease of the newborn is thus a good example of a genically-controlled disease in which the primary gene-effect (antigen-formation) is intrinsically harmless but may lead to secondary effects of a varied and severe nature. It is also a genically-controlled disease that can be successfully treated in some cases. It is possible that, when the chemical structure of the hapten portion of the blood-group antigens is known, they may be synthesized and used in the treatment of the disease in utero, for it

<sup>1</sup>[B.M.B. 872]



might be possible by their use to keep the maternal antibody-level low enough to avoid significant transfer across the placenta.

The complete suppression of undesirable genes may be attempted in two ways. The first is that of controlled breeding, or eugenics, and will not be discussed. The second is selective mutation. Agents are known that may be used to increase the mutation-rate, but none is selective; they may be said to lead to increase in the spontaneous mutation-rate of all genes. Among these are a number of chemical compounds, one of which, allyl isothiocyanate, occurs naturally in some plants (Auerbach & Robson, 1944). Other far more effective compounds are mustard-gas and some related compounds (Auerbach & Robson, 1946). Mustard-gas is a very powerful agent indeed, giving as high a mutation-rate as x-rays. These agents are non-specific, but it is possible that the investigation of the nitrogen- and sulphur-mustard groups which already show some tissue selectivity (Gilman & Philips, 1946) may lead to the discovery of compounds with some selective action on mutation. The demonstration by Demerec (1947) that the carcinogen 1:2:5:6-dibenzanthracene is also mutagenic will lead to the investigation of some of the large number of known carcinogens, and the relation between carcinogenic and mutagenic power in these should prove to be of the greatest interest.

The possibility of inducing mutation in a particular gene has led to some experimental work that is unfortunately inconclusive at present. In 1920 Guyer & Smith claimed that they had induced heritable eye-defects in rabbits by the injection of antisera against eye-lens protein into pregnant rabbits. Attempts were made by other workers to confirm these results but were unsuccessful. Recently, however, Sturtevant (1944) has said that Hyde succeeded in confirming the work of Guyer & Smith just before his death in 1943. Sturtevant's interpretation of this finding is that there is a similarity in molecular shape of the gene and the antigen it produces. Thus, antibody may combine with the gene and interfere with its duplication in such a way that the genes produced are not effective in antigen-production. This is tantamount to the induction of specific mutation. Emerson (1944) attempted to induce similar mutations in *Neurospora* by treatment with antisera prepared against *Neurospora* mycelium or *Neurospora* culture-filtrates. The material used was a mixture of antigens, and presumably gave a very varied collection of antibodies. It was found that the mutation-rate of *Neurospora* was increased by antibody treatment, but this may well have been a non-specific effect, for no controls with normal sera were done and owing to the probably-mixed nature of the antibody used, specific effects would not have been easy to detect. In spite of the interest of this work it has not been repeated or confirmed. There seem to be a number of probable difficulties in bringing gene and antibody into contact, for it is necessary not only to move antibody across the cell-membrane but to maintain a sufficient concentration of it once there, in the presence of intracellular proteases that are likely to break up foreign proteins. It seems unlikely that such methods of specific mutation will become of practical interest in human genetics, more especially because they are likely to inactivate genes, rather than restore genes that have lost their function, and consequently are likely to be of value only in modifying dominant genes.

#### 4. Non-genetic Heredity

At present there is great interest in types of inheritance that involve cytoplasmic factors for which the name "plasmagenes" has been coined. It is supposed that, like genes, these are capable of self-duplication, and that they may have properties such as to constitute a link between virus and gene. In addition to the very considerable body of speculation on cytoplasmic inheritance, there is some definite evidence that it does occur. In plants, the plastids are known to be self-duplicating bodies, liable to sudden changes that are then perpetuated. Their duplications seem to be influenced to some extent by genes. The work of Lindegren (1945) on cytoplasmic inheritance of a sugar-splitting enzyme in *Saccharomyces* has already been discussed; other work emphasizing the close interrelations that exist between intra- and extra-nuclear inheritance is that of Sonneborn (1945) on the "killer" character of *Paramecium*. The demonstration that one of the factors responsible for mammary cancer in mice appears to be extra-nuclear and self-duplicating may lead to work on cytoplasmic inheritance in higher animals. This field is discussed more fully by Haddow (1947)<sup>2</sup>. It had long been apparent that many of the factors responsible for the production of an adult from a fertilized egg were cytoplasmic. All cells in the body have the same genic constitution, but they differ greatly from each other. That this difference is not merely one of environment is demonstrated by tissue-culture in which cells do not all revert to the same type, in spite of having the same environment. In tissue-cultures, at least four distinct types of cell which all have the same genic constitution are recognizable. It may be concluded then, that these differences are due to self-duplicating cytoplasmic factors. Studies of inheritance in bacteria and mutation-like changes in viruses, such as phage, may be relevant to cytoplasmic inheritance in higher organisms.

#### 5. Future Progress

Biochemical genetics is hampered at present by our lack of knowledge of the structure of most of the more-important constituents of the cell. It is commonly assumed that the genes are nucleoprotein in nature, but we know little of the fine structure of proteins and less of the structure of nucleic acids. One of the plant-viruses was shown to contain nucleic acid in 1936 (Bawden, Pirie, Bernal & Fankuchen), yet it was not until 1947 that it was shown that this nucleic acid had 3 mononucleotides of the same composition as 3 of the 4 mononucleotides of nucleic acid from yeast (Schwerdt & Loring, 1947). About the order in which the components of nucleic acids are arranged, nothing is known, though there is evidence from the extremely fine specificity of the type-determining nucleic acids responsible for pneumococcal-capsule synthesis, that order and arrangement in space of the components may be of the greatest importance in determining specificity. The work of Todd and his school in Britain gives ground for hope that the synthesis of simple nucleic acids is not very far off (Todd, 1946). In our knowledge of the structure of the proteins we are more advanced, but again little is known of the order of different amino-acids that make proteins. A third class of high-molecular-weight polymers is the polysaccharides.

<sup>2</sup> [BMB 964]

## DEVELOPMENT OF IDEAS ON THE NATURE OF VIRUSES

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- 1 Size as a criterion
  - 2 The physico-chemical approach
  - 3 Microbes or molecules?
  - 4 Nature of the fundamental virus-particles
  - 5 Combination of virus with tissue-constituents
  - 6 Conclusions
- References

The idea that a disease can be contagious, that is, caused by direct or indirect contact with another case of the disease, is old. It appears in the Old Testament and the Decameron, to cite popular writing as evidence of a more or less general acceptance, and it was set out in a manner acceptable to scientists by Fracastorius (1546). Until bacteria had been recognized by the early microscopists no suggestions, based on evidence, were made about the nature of the infective agents. During this period the word virus was used indiscriminately to cover agents, such as snake-venoms, which cause pathological states that are not transmissible from one victim to another, and also infective agents. The restriction of the word to infective

agents came with Pasteur's unequivocal demonstration of the role of bacteria in causing disease, and it was then used for any infective material, whether an organism had been recognized in it or not. As an example of this broad use Pasteur may be quoted (1889); the translation by Ruffer is used because it appeared a year earlier than the French version of this article.

Moreover, it is not difficult to prove that rabies is a disease which cannot appear *de novo* under any physiological conditions, and that its spontaneous origin is quite impossible. We know nowadays that contagion or virulent affections are caused by small microscopic beings which are called microbes. The anthrax of cattle, malignant pustule of man, is produced by a microbe; croup is produced by a microbe . . . The microbe of rabies has not been isolated as yet, but judging by analogy, we must believe in its existence. To resume: every virus is a microbe. Although these beings are of infinite smallness, the conditions of their life and propagation are subject to the same general laws which regulate the birth and multiplication of the higher animal and vegetable beings.

On the strength of this and some other passages the suggestion that the agents causing certain diseases could be smaller than the visible bacteria is sometimes attributed to Pasteur. It is clear however that he wisely refrained from making any suggestion to explain his inability to find a rabies organism.

Ivanowski (1892) found that the sap from plants suffering from tobacco mosaic retained its infectivity after passage through a Chamberlain filter-candle but, being convinced that the disease was due to a bacterial infection, he argued that the symptoms might be due to bacteria penetrating the candle or to a toxin secreted by the bacteria. He could have disproved the latter suggestion by demonstrating that plants which showed symptoms as a result of inoculation with the filtrate had an infective sap, but he does not appear to have done so. This experiment was carried out with foot-and-mouth disease by Loeffler & Frosch (1898). They tried to make a vaccine by removing the infective particles from vesicle-lymph by passage through a filter-candle, but

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Many antigens owe their specificity to the polysaccharide moiety of the whole, among them those of the blood-groups and those responsible for type-specificity of pneumococci. A study of the former compounds is being carried out by Morgan in Britain (Morgan, 1944).<sup>3</sup>

<sup>3</sup> [BMB 422 & 555]

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were surprised to find that the filtrate still produced symptoms of disease. Although well aware of the high dilution at which foot-and-mouth lymph is infective, they argued that the effect could not be due to a toxin because the lymph from animals that had been inoculated with a filtrate produced symptoms. As an alternative they suggested that the agent, although small enough to pass through the pores of the filter, multiplied in the affected animal. They also suggested that a group of other diseases might have a similar cause. In the same year, the significance of passage through a porcelain filter was also fully appreciated by Beijerinck (1898). He filtered tobacco-mosaic virus and also demonstrated the diffusion of the infective agent through agar gels. These experiments led him to suggest that the agent was not "corpuscular" but was what he called *contagium vivum fluidum*.

### 1. Size as a Criterion

It is not easy, at the present time, to understand what precise distinction, other than the purely quantitative one of particle-size, Beijerinck was making. Atomic theories were already 2,400 years old, and the atomic and molecular conception of matter had achieved general acceptance during the 19th century. The reality of atoms was, it is true, still doubted by Ostwald and other members of the "Energetics" school, but more perhaps as a logical exercise than as a matter of practice. Clerk Maxwell spoke confidently, in an article in the *Encyclopaedia Britannica* (1875), of their reality, and even made some estimates of the number of molecules in the smallest organisms and emphasized the bearing of this subject on current theories of heredity. However, as late as 1909, Perrin entitled his masterly survey of the various independent methods by which Avogadro's number could be determined "Mouvement brownien et réalité moléculaire". When Beijerinck wrote, the nature of matter was in doubt, and even those who believed in molecules were uncertain of their size. Biologists at that date may therefore be forgiven for imagining that a fundamental qualitative difference existed between the corpuscular or particulate and the soluble or fluid states of matter; there is less excuse for the traces of the same belief that still linger in the writings of some pathologists.

Filtration through a candle was established as a practically-useful, but arbitrary, upper size-limit to the group of viruses. This was at first expressed in the phrases "filtrable microbe" or "filtrable virus", but usage and the fact that diseases resembling the virus-diseases in other ways are sometimes not transmissible by filtrates, has led to the adoption of the simple word virus to cover this ill-defined group. There is no rigid boundary between the large viruses and the small bacteria, and a discussion on the correct category for an agent like that of pleuropneumonia might have value in law but has none in science. The lower limit of size is equally uncertain. The factors causing capsule-formation in rough strains of pneumococci are generally looked on as "substances" rather than viruses, but this distinction is not logical. Transformation is associated with the production of more of the factor, so that one has the phenomenon of multiplication of the factor in susceptible organisms. Avery, MacLeod & McCarty (1944) have evidence that transformation is due to a polymerized nucleic acid. The possibility of virus-like action

with simpler substances remains open. Plant-galls can be produced by treatment with auxins; if the gall were itself rich in auxin, the state of affairs would be formally indistinguishable from an infection. An extract of the anomalous tissue would produce more of the characteristic anomaly when put on to healthy susceptible tissue. No example of this phenomenon is yet known, but it may be confidently predicted that examples will be found and that the effective auxins will be synthesizable. There will then be a smooth gradation, without any qualitative break, from synthesizable molecules at one end to microscopically-visible organisms at the other.

### 2. The Physico-chemical Approach

In the first quarter of this century the problem had been defined, certain infective states were classified as virus-diseases, and limits could be put to the size of the effective agents. It was not immediately obvious that the nature of a virus was a suitable theme for biochemical investigation, because our knowledge of the sizes of other biologically-important colloids was still meagre. It is unlikely that anyone giving serious thought to the matter doubted that viruses contained protein, because the unique role of proteins in biological phenomena had long been accepted; but protein-sizes had not been measured. Some tentative figures were derived from the elementary composition of proteins, especially from the iron content of haemoglobin, but it was not until the decade 1920-30 that osmotic pressure and ultracentrifugal measurements gave figures of generally-accepted validity.

The narrowing of the gap between the larger proteins and the smaller viruses stimulated many workers to investigate viruses from a chemical or physico-chemical standpoint. Two early purifications, that of vaccinia virus by Craigie (1932) and of a *Bact. coli* virus by Schlesinger (1933, 1936), were outstandingly successful. These viruses lack the geometrical or electrical simplicity that is a prerequisite for crystallization or the exhibiting of other striking physical properties, but it is probable that the preparations made in 1932 contained as high a proportion of active virus in the original state as most virus-preparations that have been described since. They were certainly more fully entitled to the designation "pure virus" than any plant-virus preparation made before 1940. Several attempts to purify tobacco-mosaic virus were made. Barton-Wright & McBain (1933) tentatively identified it with a protein-free crystalline material that they made from infective plant-sap. This suggestion was received sceptically by biochemists. A more confident identification by Stanley (1935) was at first similarly received. This scepticism was fully justified, for all the novel properties ascribed by Stanley to his crystalline globulin have proved not to be properties associated with the virus. The properties that are now accepted as those of tobacco-mosaic virus in its aggregated state were set out by Bawden, Pirie, Bernal & Fankuchen (1936) and were more fully defined by Bawden & Pirie (1937a) and by Bernal & Fankuchen (1941). Stanley has, from time to time, incorporated these properties in his description of the virus. This promotes unanimity but leads to the impression that his early description was confirmed rather than contradicted. Some parts of the description, e.g., the formation of tactoids in strong neutral solution, and fibres or "para-

crystals" rather than true crystals on precipitation with acid or on salting out, were accepted by Stanley almost immediately. Other parts were accepted more slowly, e.g. the invariable presence of nucleic acid in active preparations (Loring & Stanley, 1937; Stanley & Loring, 1938), and then only after argument (Bawden & Pirie, 1937b). The properties found with these early preparations are those of aggregates (Bawden & Pirie, 1937a; 1938c; 1946); this very important point has not yet been accepted by Stanley. It will be referred to more fully later. The sap of plants infected with various other viruses has yielded characteristic nucleoproteins which are either the viruses or are related to them. Some of these resemble tobacco-mosaic virus in forming liquid crystals, e.g. potato X (Bawden & Pirie, 1938a) and potato Y (Bawden & Pirie, 1939); others form true three-dimensional crystals, e.g. bushy stunt (Bawden & Pirie, 1938b), tobacco necrosis (Pirie, Smith, Spooner & McClement, 1938; Bawden & Pirie, 1942) and turnip yellow mosaic (Markham & Smith, 1946).

### 3. Microbes or Molecules?

The preparation of so many plant-viruses in forms with characteristic chemical and physical properties has fostered two unfortunate illusions: that there is a qualitative distinction between plant- and animal-viruses and that plant-viruses have been shown to be substances or molecules rather than organisms. More than 200 plant-viruses or virus-strains are known, and only about 20 have been subjected to serious chemical or physical study. These have been selected for detailed study largely because they give a highly infective sap, which retains its infectivity in spite of the various changes that go on in ageing leaf-extracts. These are more or less chemical criteria, and any uniformity which appears to run through the group of plant-viruses is at least as likely to be due to this initial selection as it is to be due to a genuine uniformity in the viruses. Animal-viruses have, from a chemical point of view, been chosen at random; that is to say they have been chosen for their social or economic importance. Those so far investigated, notably by Beard and his associates, have tended to be larger and more complex chemically than the plant-viruses, but it would be premature to make any generalizations until many more have been investigated.

The distinction between molecules and organisms, in any region where this distinction could be uncertain, is purely verbal. In so far as it can be defined, it is between materials that are handled by the methods characteristic of a biochemical laboratory and materials handled by methods characteristic of a biological laboratory. But many well-known materials are habitually handled in both ways. We all agree that *Bact. coli* is an organism, but when it is being disintegrated to make an enzyme-preparation or hydrolyzed as a prelude to amino-acid analysis, it is being treated as a substance and, but for the preliminary agreement, might be looked on as a molecule. The position with viruses is similar. No one has demonstrated that some of them are substances or macromolecules. Indeed, such a thing is not susceptible of demonstration; it is not a statement about the viruses but about the mental approach and technique of the research-worker. It has, however, been amply demonstrated that, as Beijerinck suspected, valuable information about their properties can be won by the methods of biochemistry.

Valuable as the contributions of biochemistry to the study of viruses have been, they are not without danger. The application of some chemical methods to the study of a group of substances does not guarantee the amenability of these substances to all other chemical criteria. Uniformity is the most important of these. In the study of the simpler molecules, on which the main structure of chemistry rests, any difference in composition between two molecules is quantitatively significant because the weight of an atom is an appreciable fraction of that of the molecule. Even the smaller proteins are so large that this is no longer true, and the replacement of one amino-acid residue by a different but similar one would not be detected by any of the elementary analyses or physical measurements so far made. *A fortiori* such a replacement would not be detectable in a virus. In the absence of any possibility of demonstrating that all the particles in a virus-preparation are identical, there seems to be little point in asserting that they are molecules. The only effect of this assertion is to rob a useful word of the meaning that it has in the more rigid discipline of chemistry. As soon as a particle has become so big that the introduction of, for example, a  $-\text{CH}_2-$  group has no longer an observable effect on the particle-size or analytical composition, the word molecule has become misleading (cf. Pirie, 1940; 1946). Clerk Maxwell (1875) distinguished clearly the use of the word by chemists, to mean identical primary particles of a substance, from the use by physicists, to mean a particle in a fluid that did not break up during the observation. This distinction is in danger of being disregarded, and the demonstration of physical molecularity is loosely taken to imply chemical molecularity as well.

The argument in the preceding paragraph is designed to show that, even if successive preparations of the same virus from different sources cannot be shown either to differ from one another or to be inhomogeneous, there is still no basis for the claim that all the particles are identical in the sense that those of, for example, sucrose are. Such an argument is not, strictly speaking, necessary, for even those viruses for which the molecular claim has been made most persistently are demonstrably variable and inhomogeneous. The particle-weight and analytical composition attributed by Stanley and his colleagues to tobacco mosaic have ranged over a wide field. Even in the same paper different values may be given; thus Gaw & Stanley (1947) quote phosphorus-values, one of which is 25% higher than the other, as evidence that a strain of tobacco-mosaic virus is the same when grown on tobacco as when grown on phlox. It is unlikely that such evidence would be acceptable in other fields of chemical research.

It is clear, both from first principles and from a consideration of the type of evidence that is actually published, that the idea of viruses as molecules in the strict chemical sense is misleading. Beard (1945; Hook *et al.* 1946) has ably presented the case against regarding some of the animal and bacterial viruses as molecules. He tends to contrast them, because of their variability in composition and particle-size, with the plant-viruses and other materials often classified as macromolecular. An experience of a fairly wide range of these substances, including plant-viruses, proteins, bacterial antigens, agar and hyaluronic acid, suggests that this distinction is unreal. The variability of these substances may not be so great as that of the

viruses which Beard has studied, but the difference is quantitative only.

#### 4. Nature of the Fundamental Virus-Particles

Variation between individual virus-particles or between successive preparations of the same virus can arise in many ways. There is no *a priori* reason why the property of being virus, that is to say of transmitting a certain set of symptoms or behaving in some other defined way, should be associated with a unique chemical structure. The virus-building mechanism may make a range of products, all active and similar, but not identical. It is equally probable that initially-identical particles should become non-uniform through association, dissociation, or the adsorption of components from the environment. Bawden & Pirie (1945) have some evidence that the last two processes operate to control the properties of tobacco-mosaic virus. In their view, the free virus aggregates in solution, but this aggregation can be prevented by other adsorbed materials. They suggest tentatively (1937a, 1945) that the primary particle is more or less spherical and smaller than the rods which are the predominant constituent of old or roughly-handled virus-preparations. Stanley stoutly defends the position that the rods, which Bawden and Pirie had described, are the fundamental particles, and that all others are derived from them. He has (Oster & Stanley, 1946; Sigurgeirsson & Stanley, 1947) published electron-micrograms purporting to show the original state of the virus in the cell. His technique, however, involves exposing the virus to that unphysiological fluid "leaf sap" which, as Bawden & Pirie (1945) have demonstrated, is a powerful aggregating agent. Furthermore, there are serious limitations to the use of electron-micrograms in getting evidence of this type (cf. Pirie, 1945; Crook & Sheffield, 1946). Stanley's position has the obvious merit of simplicity, but this simplicity can be achieved only by disregarding much of the available evidence.

#### 5. Combination of Virus with Tissue-Constituents

The presence of material, attached to the particles in a virus-preparation but not essential for the activity of the preparation, has been recognized with many other viruses. Curnen & Horsfall (1947, and earlier papers) have studied the complex that the pneumonia virus of mice makes with a constituent of lung and other tissues. Free virus can be made, and this will then combine with the tissue-constituent *in vitro*. It therefore seems probable that the complex is an artefact made during the extraction of lung by the original methods as a result of bringing together components not normally in contact in the tissue. Influenza-virus preparations contain material reacting with antisera against chick-embryo or mouse, depending on which host has been used for cultivating the virus (Knight, 1946). Virus free from these components has not yet been made, and it is therefore not possible to say whether, here also, the complex is an artefact, or whether some components of the host are essential for the stability of the virus-particle. Cohen (1946) has described a phenomenon in the T2 virus

of *Bact. coli* which may have a similar origin. When grown on a synthetic medium, the virus is associated with extra desoxyribose nucleic acid and this can be removed from it, without loss of virus-activity, by digestion with desoxy-ribonuclease. Here, therefore, an apparently homogeneous virus-preparation contains material inessential for virus-activity. There is no evidence showing whether it has any relationship with normal host-cell components or not. The tumour-viruses give many examples of similar phenomena. Carr, for example, has good evidence (1944) that the antibodies, built up in an animal carrying a Rous No. 1 sarcoma, progressively reduce the filterability of the tumour-virus, presumably by precipitating it in the interstices of the tissue. The only apparent difference between this and the other examples of complex-formation quoted is that the complex never appears in suspension. There is no evidence for anything analogous to antibody-formation in plants; it is therefore unlikely that precipitation of this type explains Bawden & Pirie's (1946) observation that the greater part of the virus in plants with tobacco-mosaic is not in solution but firmly attached to the structure of the leaf. If this phenomenon is at all general, it greatly widens the field of complex-formation.

#### 6. Conclusions

In recapitulation it may be said that our ideas about the nature of viruses are now based on much information, but that this has increased rather than diminished the complexity of the subject. It is a matter of observation that there is no clear demarcation between viruses and bacteria, and there is probably no demarcation between viruses and physiologically-active but synthesizable molecules. All the viruses purified so far have contained nucleoprotein, but this generalization may lack significance because the viruses that have been studied are a group selected to some extent on a chemical basis. Furthermore, the purified virus is the minimum unit capable of starting the infective process in a susceptible cell. It may well be that an essential preliminary to the process of multiplication is the accretion to the virus of various other cell-constituents. This view has for long seemed probable *a priori* (cf. Dale, 1935); the frequency with which viruses, if isolated by gentle procedures, are associated with host-cell constituents is confirmatory evidence for it. It becomes a matter of arbitrary definition at what point, in stripping away host-components from a virus, one is purifying it, and at what point one is modifying it. These considerations need emphasis because of the frequency with which the supposed facts of virus-research are used in discussions on other branches of biology. There are clearly resemblances between viruses and genes (Muller, 1922) or other tissue-components (Claude, 1941) but caution is necessary in arguing from these resemblances. In commenting on the position it would be difficult to improve on Beard's (1945) felicitous phrase: "Viruses are said to be living molecules and autocatalytic enzymes and are likened to genes and mitochondria—in short, a fabric of concepts has been woven of a plethora of wool with a paucity of warp."

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## CONTRIBUTIONS OF CHEMISTRY TO THE PROBLEMS OF IMMUNOLOGY

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- 1 Mechanisms of immunity
  - 2 Antigens and their immunological specificity
  - 3 Chemically-altered and conjugated protein-antigens
  - 4 Bacterial and other cell-antigens
  - 5 Blood-group substances
  - 6 Antibodies and the antigen-antibody reaction
  - 7 Inhibition tests (competitive inhibition)
  - 8 Hypersensitivity or allergy to simple chemical compounds
  - 9 Complement
  - 10 Miscellaneous
  - 11 Possible future developments
- References

This is a not inopportune time for a review of the present position of immunochemistry and of the contributions that chemistry has made to this branch of science. The phenomena of immunity are essentially chemical, and we might reasonably expect that some of its problems will soon be solved if a more sustained chemical and biochemical attack is made on them.

Ehrlich can be credited with some of the earliest efforts to apply the principles of chemistry to immunity. He believed that the combination of toxins with animal cells on the one

hand, and with antitoxins on the other, were processes which obey the ordinary laws of chemistry and physics. His "side-chain" theory, with its toxophore, haptophore and other receptor groupings, certainly became very complicated in the various modified forms which were developed to meet objections to his theory, but at least it gave stimulus to an immense amount of discussion and scientific investigation; above all, it gave a pictorial conception of the interaction of antigen and antibody by chemical reactions. These views were, however, strongly opposed by Bordet, who maintained that immune reactions take place as a result of physical or colloidal processes, with emphasis on adsorption. The comforting terminology of the early colloidal chemistry satisfied most immunologists for a long time, and, as Heidelberger (1946) aptly remarked, "many of those who once found it useful and comfortable still think of it with nostalgia". Evidence of this can readily be obtained from many textbooks of pathology and bacteriology, but it must be recorded with regret that in 1927 a well-known biochemist, surely in a moment of mental aberration, subscribed to the view that complement may merely be a name for a physical state of the serum.

During the past two or three decades the position has shown material improvement, in the eyes of the chemist, thanks to the efforts of such men as Arrhenius, Wells, Landsteiner, Zinsser, Heidelberger, Avery, Marrack and a host of others, who have tried to think of immunology in terms of chemistry. Above all, Landsteiner might perhaps be regarded as the father of modern immunochemistry. Wells' *Chemical aspects of immunity* (first published in 1924 and revised in 1929) was certainly a milestone recording progress in the development of this subject, and giving encouragement to those who had just joined the pilgrimage, but it was largely the laboratory investigations of Landsteiner over the period 1906-43 which formed the basis of our knowledge of immunological specificity. As befitting one who had served an apprenticeship in Emil Fischer's laboratory, Landsteiner was able to think of antibody formation and the reactions between antigen and antibody in terms of organic

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chemistry; and the modern concept of the chemistry of serological specificity rests largely on his work and the work of those who followed his example. Avery and Heidelberger, with their isolation of the specific polysaccharides of the pneumococcus, and Heidelberger and his colleagues, with their use of analytical chemical methods for the study of antigen-antibody reactions, have done much to provide rational explanations for many immunological phenomena.

### 1. Mechanisms of Immunity

The chemist is particularly interested in the structure and composition of antigens and antibodies. A "true" or full antigen is a compound which on injection into an animal produces antibodies capable of reacting specifically with the antigen, e.g., by precipitating or agglutinating it. Certain polysaccharides and some other non-protein compounds, which, although incapable of inducing any marked antibody-formation when injected, can react *in vitro* with specific antibodies, are termed haptens (Landsteiner), and much information about the chemistry of immunity has come from the study of these compounds.

The view is widely held that antibodies may be the real key to immunity, but it also seems probable that some or all of them may act in collaboration with the phagocytes. Precipitation or agglutination of the bacteria or foreign substance may not actually occur *in vivo*, but there appears to be no doubt that chemical combination of antigen and antibody does take place in the animal body; the elimination of the precipitated or "neutralized" material requires the help of phagocytic cells, complement, and possibly other non-specific defence-agents of the body.

The study of phagocytosis has not been neglected by chemists (cf. review by Mudd, McCutcheon & Lucké, 1934), and the opsonins which facilitate and promote phagocytosis have also been investigated. There is, however, the need for a renewed attack on phagocytosis and opsonic action with the more modern weapons of chemistry.

In recent years, much interest has been shown in other non-specific resistance-factors of the tissues, such as leucotaxine (causing leucocyte emigration to the infected area), hyaluronic acid, hyaluronidases ("spreading" or "diffusing" factors), and lysozyme. Leucotaxine, described by Menkin (for the literature, see Hadfield & Garrod, 1942, and Boyd & Malkiel, 1947) has been isolated as a crystalline and extremely potent product having the properties of a polypeptide. Hyaluronic acid, present in certain bacterial capsules, is a polymer of acetyl-glucosamine and glucuronic acid, and the enzyme hyaluronidase has been obtained in a highly purified form and its polysaccharide-splitting activity fully studied. Lysozyme, which is widely distributed in nasal secretion, saliva, tears, leucocytes, and egg-white (Fleming, 1922) has been isolated as a crystalline protein (Abraham & Robinson, 1937; Alderton, Ward & Fevold, 1945); it has a molecular weight of about 17,000, and an iso-electric point between pH 10.5 and 11.

The immunological role of hyaluronic acid and hyaluronidases, and the significance of the production of hyaluronic acid by some bacteria, and of hyaluronidase by others, have yet to be elucidated. The functions of lysozyme are also not yet established, for most pathogenic organisms show little if any susceptibility to its action. The chemist has, however, paved the way to a full-scale attack by exposing

some of the mysteries of these tissue- and cell-defences; now that many of these resistance-factors are becoming available in a chemically pure state, there is a much greater hope for success in the study of these problems.

### 2. Antigens and their Immunological Specificity

Since most full antigens are proteins or protein-containing complexes, it is not surprising that the serological specificity of proteins has been extensively studied. As a result of this work (cf. reviews by Landsteiner, 1945; Boyd, 1943), we know that this specificity depends on the chemical structure of the antigens. It is not always possible by laboratory methods to detect chemical differences between two closely-related natural proteins which the rabbit can readily distinguish by producing antibodies which react with one protein and not with the other; but more refined chemical technique will almost certainly render this possible. Chemistry has undoubtedly made valuable contributions to our knowledge of antigen and antibody specificity, and much greater progress should be made in the future by closer collaboration between biochemists and immunologists.

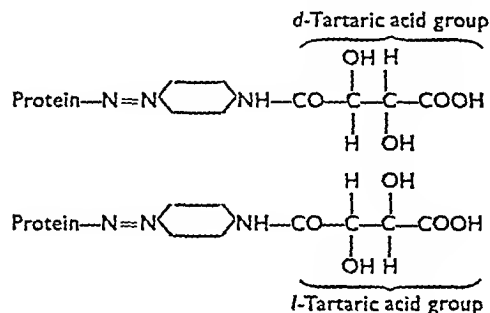
Immunological activity is, of course, not confined to the proteins, for the specificity of certain bacterial and other cells is largely due to carbohydrates and carbohydrate-lipid complexes. Some purified lipids can also act as specific antigens. In all these cases a chemical attack has been made, and much useful information has been obtained about the chemical groups responsible for the serological specificity of these antigens.

### 3. Chemically-altered and Conjugated Protein-Antigens

An extensive study has been made of the specificity of protein-antigens by the attachment of various well-defined groups to proteins to produce complexes having serological properties different from those of the original protein. The most successful method, and one which has been used by numerous workers, is that introduced by Landsteiner & Lampl (1917); it involves the use of a compound containing a diazotizable amino-group and the coupling of the diazotized compound with a protein to form an azoprotein complex. Studies on a wide variety of azoproteins have shown that this conjugation gives the protein a new specificity dependent on the "determinant" group introduced, and on the spatial configuration in that group. A full account of these investigations is given by Boyd (1943), Marrack (1938) and Landsteiner (1945), and all that is possible here is a brief reference to a few fundamental discoveries. Landsteiner & van der Scheer (1932, 1934, 1939) attached peptides containing 2 to 5 amino-acid molecules to proteins, and found that although the specificity of these conjugated proteins was partly due to the nature, order, and the number of the amino-acid molecules attached, the predominant influence was exerted by the amino-acid at the free end of the peptide chain. Shortly before this, the same authors (1928) found that serological tests could readily differentiate between the *d* and *l* isomers of phenyl-(*p*-aminobenzoylamino) acetic acid and in a more striking way the isomers of tartaric acid (1929). In the latter case, the immunized rabbit differentiated sharply between azoproteins which differed only in the arrangement of the H and OH groups in the tartaric acid portion of the tartranilic acid linked to the protein. Fig. 1

indicates diagrammatically the delicacy of this serological differentiation.

FIG. 1. TARTARIC ACID AZOPROTEINS



Steric isomers of this type were also studied by Avery & Goebel (1929), who obtained serological differentiation between azoproteins containing glucose and those containing galactose. In further investigations on these carbohydrate-azoproteins, Goebel (1940) succeeded in immunizing mice against pneumococci of Types II, III and VIII by injecting into them antisera towards azoproteins containing cellobiuronic acid (a disaccharide containing one molecule of glucose and one of glucuronic acid). This production of an effective immunity towards an actual disease by the use of an artificial antigen containing a synthetic hapten marked a distinct advance in immunochemistry.

In more recent years Harington has introduced the use of the reaction between azides and the free amino-groups of proteins to produce conjugated proteins in which the haptenic group is linked to the protein by a peptide linkage. This elegant method (Clutton, Harington & Mead, 1937; Clutton, Harington & Yuill, 1938) has been successfully used for the production of antisera against thyroxine (for the references cf. Harington, 1944a) and aspirin (Butler, Harington & Yuill, 1940).

Protein specificity has also been studied by the direct introduction of atoms or small groups into the protein molecule, this process usually inducing in the protein a new specificity characteristic for the grouping introduced (cf. reviews by Landsteiner, 1945; Wells, 1929; Wormall, 1937). In this way, useful information has been obtained about immunological specificity, and indirectly about the structure of proteins. The actual determinant groupings in natural protein-antigens is not yet known, but the nature and order of the amino-acids in the polypeptide chains undoubtedly has a decided influence. The carbohydrates naturally linked to egg-white proteins do not appear to play any part in determining the serological specificity of these glycoproteins (Neuberger & Yuill, 1940).

#### 4. Bacterial and other Cell-Antigens

Important progress has been made in the investigation of the chemistry of the antigenic mosaic of the bacterial cell. In many instances the components of these antigenic complexes have been separated and identified, and their biological action investigated, and this field of immunological research has been "one of the most fruitful in discoveries of both theoretical and practical importance" (Dubos, 1945, p. 234).

The chemical nature of bacterial antigens has been well reviewed in this journal by Morgan<sup>1</sup> (1944a), with an account of typical haptens and antigens from some gram-positive and gram-negative organisms. Considerable progress followed the separation by Boivin and his colleagues in 1933 (for the literature, cf. Morgan, 1944a; Landsteiner, 1945), and by Raistrick & Topley (1934), of highly antigenic complexes containing specific polysaccharides and lipids.

The more-recent use of special reagents for the separation and partial degradation of the complexes has yielded non-antigenic undegraded specific polysaccharides and non-antigenic phospholipin-polysaccharide complexes. For example, Morgan & Partridge (1941, 1942; cf. also Morgan, 1943) have obtained evidence that the protein component of the phospholipin-polysaccharide-protein antigen isolated from *Bact. dysenteriae* (Shiga) and *Bact. typhosum* is a conjugated protein, and Freeman (1943) has obtained an antigenic complex from *S. typhimurium* which is believed to be a chemical entity; this complex contains specific polysaccharide (69%), a conjugated protein (16%), mixed lipids (3-4%), and an alcohol-soluble acetylated polysaccharide (about 8%).

To establish the exact constitution of an organic compound the chemist first analyzes it, and then splits it into its component pieces. A provisional formula might then be given to the compound, but final proof of this formula usually awaits synthesis of the compound from simpler substances of known constitution. As a natural corollary to the analysis of bacterial antigens, attempts have therefore been made, with considerable success, to re-combine the isolated polysaccharide and the conjugated protein, and thus to form complexes which are antigenic and which produce antibodies specific for the polysaccharide component. In a similar way, other non-antigenic polysaccharides, and the haptenic specific blood-group agglutinogens A and B, have been converted into full antigens by combination with a bacterial somatic conjugated protein (cf. Morgan 1943, 1944a).

Amongst other observations of special interest to chemists is that of Avery, MacLeod & McCarty (1944). These authors isolated from Type III pneumococcus a polymerized desoxyribonucleic acid which, when added to a medium in amounts as low as 1 part in  $6 \times 10^8$ , can effect the transformation of Type II pneumococcus into Type III, a change of specificity which is permanently retained by the organism.

#### 5. Blood-Group Substances

Much information has been obtained (cf. Morgan, 1944b<sup>2</sup>, 1947; Witebsky, 1946) about the chemical nature of the blood-group substances A, B and O, particularly the A substance, since it can readily be prepared on a large scale from hog gastric mucosa. The highly potent purified A substance contains 5.7-6.4% N, 9.2-11.5% acetyl and 27% hexosamine (Morgan & King, 1943). Purified preparations of these group-specific substances have been used to reduce the anti-A (or anti-B) titre of group O blood to be used for transfusion (Witebsky, Klendshoj & Swanson, 1941), and also for injection into man to produce strong grouping-serum (Witebsky, Klendshoj & McNeil, 1944).

<sup>1</sup> [B.M.B. 555]  
<sup>2</sup> [B.M.B. 422]

## 6. Antibodies and the Antigen-Antibody Reaction

Antibodies have been shown to be adapted or slightly modified serum-globulins, and their combination with various antigens in the precipitin reaction has been studied quantitatively by many workers, notably by Heidelberger and his colleagues. From chemical analyses of antigen-antibody precipitates a quantitative theory of the precipitin reaction was developed (Heidelberger & Kendall, 1935, and later papers; cf. reviews by Heidelberger, 1939, 1946; Kendall, 1942). The data obtained support the view that both antigen and antibody are multivalent, thus giving strong quantitative support for the "lattice" or "framework" theory of Marrack. Space does not permit further discussion of these fundamental analytical investigations, and of the equations and formulae developed to give a quantitative expression to the precipitin and other immune reactions, but the reader is referred to the stimulating and provocative reviews by Boyd (1943), Pauling (1940) and Pauling, Campbell & Pressman (1943). Useful accounts of the applicability of quantitative methods in immunochemistry are given by Kabat (1943) and Treffers (1944), and the nature, properties and formation of antibodies have been reviewed by Marrack (1942) and Haurowitz (1947). Methods for the quantitative determination of antibodies are now fully established (cf. Heidelberger, 1946), and according to Dubos (1945, p. 272) this ranks as "one of the great achievements of immunochemistry".

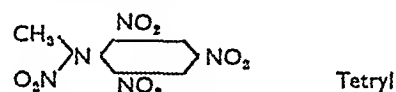
## 7. Inhibition Tests (Competitive Inhibition)

Modern investigations in chemotherapy have been largely re-orientated since the recognition that many bactericidal compounds, narcotics, and other drugs act by competition. It is often overlooked, however, that competitive inhibition in enzyme systems had been studied at an earlier date, and that the specific inhibition of serological reactions had also been described. Landsteiner (1920) showed that simple substances having structures identical with, or similar to, the hapten group of azoproteins could specifically inhibit the reaction between the azoprotein and its antiserum. Since that date, serological inhibition-tests have been used very extensively (cf. reviews by Marrack, 1938; Boyd, 1943; Landsteiner, 1945) and valuable information has thereby been obtained about the "determinant" or serologically-dominant groups in many antigenic complexes and chemically-altered proteins, and about serological specificity in general. This inhibition-test technique greatly simplified many immunochemical studies and greatly widened the field of investigation. Work carried out in Landsteiner's laboratory showed, for example, that the specificity of iodinated-protein antigens is due to the 3:5-diiodotyrosine groupings (Wormal, 1930). Proof that the inhibiting compounds actually combine with the antibodies was obtained by Marrack & Smith (1932), and later by Haurowitz & Breinl (1933).

## 8. Hypersensitivity or Allergy to Simple Chemical Compounds

The acquired hypersensitivity of an individual to a protein or a protein-containing complex might be explained by assuming that previous exposure to the material had produced antibodies which rendered the subject specifically allergic or hypersensitive to the "allergen". Hypersensitivity to simple compounds ("drug allergy") could not be so readily

explained, until it was gradually realized that the exciting agents might have been rendered fully antigenic by combination with the body-proteins to produce new protein-complexes which were "foreign" and therefore antigenic to the body. Full confirmation of this view has been obtained by various workers, and Landsteiner & Jacobs (1935) were able to sensitize guinea-pigs with dinitrochlorobenzene, picryl chloride, and many other comparatively simple aromatic compounds, several of which are known to produce hypersensitivity in man. Various workers have obtained further evidence of this formation of antigenic conjugates (cf. Landsteiner & Chase, 1937a, 1937b, and the review by Landsteiner, 1945); and Harington (1944b) and his colleagues have succeeded in sensitizing guinea-pigs to tetryl, and have obtained evidence that the sensitization is due to the action of the tetryl on the skin-proteins.



All types of drug allergy cannot, of course, be accounted for on the basis of combination of the drug with body-proteins to form a "foreign" protein. There is, however, an increasing amount of evidence that the ordinary protein molecule contains a variety of very reactive groupings, and that it can combine with many compounds which chemically are regarded as very inert; the trypanocidal drug suramin (Bayer 205), for example, firmly combines with serum- and other proteins (Dewey & Wormal, 1946). Thus it seems possible that immunochemical studies, and others concerned with the interaction of drugs and proteins, may help to throw some light on drug allergy.

## 9. Complement

Not many years ago complement was regarded as one of the insoluble mysteries of immunity, and the specific lytic action of this reagent or system was often referred to as a special physical property of the serum (for the early literature see Osborn, 1937). At last the faith of many chemists is gradually being justified, for three of the four known components of complement have now been isolated in a highly purified form. Many authorities regard complement as a keystone in the immunity defence-systems of the body, and a clearer knowledge of this agent should undoubtedly greatly improve our chemical knowledge of immunology. Work in this field has been greatly stimulated by the use of the more-refined methods of physical chemistry by, amongst others, Ecker and Pillemer (cf. Ecker & Pillemer, 1942; Pillemer, 1943) and Heidelberger. Exact details have been given (Bier, Leyton, Mayer & Heidelberger, 1945) for the titration of the four individual components of complement, and from many laboratories useful information is forthcoming about the chemical properties of these components and their role in serological tests (cf. reviews by Marrack, 1942; Kabat, 1946). Perhaps we shall not have to wait long now before we learn the chemical mechanism underlying the specific destruction of the fourth component of complement by ammonia and ammonium salts, and the specific adsorption or inactivation of the third component by an insoluble yeast-carbohydrate. We might also find the answer to the question as to whether one of the components is an enzyme and another a lipid.

## 10. Miscellaneous

There are many other branches of immunochemistry where vigorous chemical attack has been, and is being made, with considerable success. It will merely be possible here to mention a few reviews and other publications, and perhaps the reviewer will be forgiven if this selection is considered rather arbitrary and haphazard. Reviews and discussions on anti-hormones (Thompson, 1941), anti-enzymes (Sevag, 1945), the production of antisera against thyroxine (Harington, 1944a), the chemistry of viruses (Andrews<sup>3</sup>, 1944; Pirie<sup>4</sup>, 1946), nutrition and resistance to infection (Schneider, 1946) and several papers on the production of antisera against the "sulpha" drugs, various antibiotics and carcinogenic compounds, indicate some of the problems which have interested immunochemists. Isotopic tracers are also being used to study immunity (Schoenheimer, Ratner, Rittenberg & Heidelberger, 1942; Heidelberger, Treffers, Schoenheimer, Ratner & Rittenberg, 1942; Bournsnel, Dewey, Francis & Wermall, 1947), and immunochemical methods have been used to study the action of mustard gas on proteins (Berenblum & Wermall, 1939; Bournsnel, Francis & Wermall, 1946). Pauling (1945) has given an excellent account of molecular structure and intermolecular forces in relation to immunity, and a modern claim has been made (Pauling & Campbell, 1942a, 1942b) that antibodies can be made artificially in the test-tube. Northrop (1942) has isolated a crystalline diphtheria-antitoxin.

## 11. Possible Future Developments

The reactions of an immunochemist who might happen by chance to glance at this review 30 or 50 years hence are difficult to anticipate. They are fairly certain to be somewhat critical, but nevertheless the temptation to speculate on possible future developments in immunochemistry is too

great to be resisted by the present reviewer. It seems probable that more of the "heavy guns" of chemistry and physics will be brought into action, and that more of the modern weapons, including radioactive and stable isotopes, will be brought into play. The USA, by virtue of its good fortune in having large supplies of these special isotopes available for tracer work, will almost certainly take a leading part in these investigations. Just as the isotopic-tracer method has solved some of the most complex problems of biochemistry, so it should help to explain some of the mysteries of immunity.

Further advances might also be expected by the use of antibodies against vitamins, enzymes, hormones, and drugs of special chemotherapeutic interest. Immunochemical methods might, for example, throw some light on the production of drug-resistant strains of micro-organisms, and if there is an undue development in nature of these drug-resistant strains, more reliance might have to be placed on immunological methods of treatment. Another possible development is the extended use (perhaps therapeutic) of nucleic-acid derivatives, similar to that isolated by Avery and his colleagues, for the transformation of organisms into less-virulent strains, and for producing mutations of micro-organisms for biological investigation.

More chemical information about the blood-group factors, including the Rh factors, should almost certainly be obtained before very long, and this might help considerably towards solving some of the remaining problems of haemagglutination in blood-transfusion and pregnancy.

There are many other avenues which are fairly certain to be explored, but sufficient has been said here to indicate a few of the contributions which chemistry has made, and will make, in the study of immunology. It might also be claimed that immunochemistry has a double role, for even as the chemist can assist in revealing some of the mysteries of immunology, so can immunological methods be profitably used to study some of the general problems of biochemistry.

<sup>3</sup> [BMB 551]<sup>4</sup> [See also BMB 1201 in this number.—Ed.]

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- In a short review of this type it is impossible to quote more than a small fraction of the literature. For more-comprehensive surveys, the reader is referred to the reviews of Boyd (1943), Hartley (1931), Heidelberger (1938), Landsteiner (1945), Marrack (1938), Sevag (1945), Topley & Wilson (1946), and Wells (1929). Valuable up-to-date articles are given in the *Ann. Rev. Biochem.*, some of these being mentioned below; others are by Chase, M.W. & Landsteiner, K. (1939, 8, 579) and Heidelberger (1932, 1, 655; 1933, 2, 503; 1935, 4, 569).
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## FIBROUS PROTEINS AS COMPONENTS OF BIOLOGICAL SYSTEMS

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- 1 Types of fibrous protein
  - 2 Soluble fibrous proteins
  - 3 Structure of the keratin—epidermis—myosin—fibrinogen group
  - 4 Interrelation of the soluble fibrous proteins
    - a General similarities
    - b Significant functional similarities in fibrinogen and myosin
    - c Possible relation of myosin and tropomyosin
  - 5 Chemical make-up of interrelated proteins
- References

The manifestations of life arise from a multitude of chemical reactions which are accelerated by a corresponding variety of protein molecules, the biological catalysts which we call enzymes. In this respect, life and catalysis are synonymous

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terms. For most people, the great ingenuity of these reactions, and their importance in metabolic processes, excite much more interest than the nature of the molecules which catalyze them. This is not at all surprising, since the nature of an enzyme is wrapped in the greatest problem which confronts mankind—the elucidation of protein structure.

As far as we know, most enzymes, and therefore most proteins, are corpuscular, and an exact formulation of their structure demands a knowledge of the number of separate peptide chains in the molecule, the sequence of amino-acids along the chains (which are not themselves necessarily identical), the way the chains are folded, and the manner in which the folded individual chains are brought together to form the native protein molecule. It is recognized that certain patches on the molecule, consisting of a precise arrangement of chemical groups, are responsible for enzyme activity and for the specificity of the catalyzed reaction. In many enzymes, sulphhydryl groups participate in this spatial array of groups, but others are also involved. The existence of such groupings raises another fundamental problem of the structure of proteins: whether they arise by the manner of folding of the peptide chain, or from a formalized fold by the sequence of amino-acids along it. Such questions have a teleological flavour until the mechanism of protein synthesis is elucidated.

### 1. Types of Fibrous Protein

In the light of these immense problems, it has seemed more profitable to investigate those types of proteins which, superficially at least, are not quite so complex. These are

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the fibrous proteins, in which the polypeptide chains are fully, or almost fully, extended, as in collagen (Astbury, 1940), silk, feather keratin (see Astbury & Bell, 1939); or show a regular and probably simple type of fold as in epidermal appendages (hair, horn), the epidermis itself (Rudall, 1946), fibrinogen (Bailey, Astbury & Rudall, 1943), myosin (Astbury & Dickinson, 1940) and tropomyosin (Bailey, 1946). Such proteins have lent themselves well to x-ray studies, since their diffraction patterns can be interpreted in broad outline, though much of the detail is unexplained. Of these proteins, the collagens and keratins serve either as supporting or protective structures, but others like fibrinogen, myosin (the contractile agent in muscle) and tropomyosin, whose properties suggest that it may be a small unit of myosin itself, are more truly functional. We shall consider these latter proteins in relation to their biological function, their structure and amino-acid composition, and attempt an interrelation of these several aspects. All three proteins are of mesodermal origin but, as we shall see, the evidence from structure alone does not suggest a fundamental difference from the proteins of ectodermal origin (hair, fibrils of the epidermis; Rudall, 1946). All possess the characteristic  $\alpha$ -pattern, indicative of a regular folding of the polypeptide chain, all are reversibly elastic and can be transformed to the  $\beta$ -form which is characteristic of certain naturally-occurring keratins. There does not appear to be any well-marked histogenic relationship between proteins; collagen, for example, is derived from mesenchymal mesoderm but is quite distinct constitutionally from the mesodermal proteins cited above.

## 2. Soluble Fibrous Proteins

Whilst the fibrous character of keratins, collagens, elastin and reticular tissue is obvious from their mechanical properties, the soluble fibrous proteins are not so easily isolated, and may be more numerous than is generally recognized. Biologists have been aware that anisometric particles may be present in the protoplasm of all cells (Lawrence, Needham & Shen, 1944). Their existence has been inferred largely by optical and other physical methods, but nothing is known of their nature. It has even been suggested that such molecules may arise by the unfolding of corpuscular proteins (Lawrence, Miall, Needham & Shen, 1944). This seems most unlikely, for there is no reason to suppose that anisometric proteins are any less organized than their formulated precursors; fibrinogen and myosin are both sensitive to their environment in respect of physical changes and impairment of biological properties. They must be built by a mechanism just as specific as those presumed to elaborate a corpuscular protein; an extensive unfolding process would tend to a randomness unsuited to Nature's ends. We must thus exercise some caution in interpreting the structure of the keratin, epidermis, myosin, fibrinogen (k-e-m-f) group as something rather simple. That they appear to have a common small-scale intramolecular pattern, which is built up into a grid-structure of side-chain to side-chain and back-bone to back-bone, helps us to a visual interpretation of structure which is lacking for the corpuscular proteins. But it is evident from the results of small-angle diffraction (see Astbury, 1943; Schmitt, Bear, Hall & Jakus, 1946) and electron-microscope studies (Hall, Jakus & Schmitt, 1945), that proteins both of  $\alpha$ - and  $\beta$ -type often possess a larger repeating-pattern superimposed

upon the smaller which so far has defied exact interpretation. It is as though we saw the small repeating units of a tapestry and not the integrated pattern.

## 3. Structure of the Keratin-Epidermis-Myosin-Fibrinogen Group

In what follows, we should be sure of what is fact or near-fact, and what is hypothesis, and to what extent our knowledge of fibrous proteins surpasses that of the main body of proteins which we call corpuscular. Firstly, we can differentiate by x-ray diffraction those families of proteins which both structurally and otherwise are quite distinct: on the one hand, the collagen group, and on the other, the k-e-m-f group. The distinction between the two is explained and supported by analysis, since the anomaly of the restricted length of the amino-acid residue in collagen could arise from the large numbers of proline, hydroxyproline and glycine residues occurring in the *cis* position in the peptide chain. The k-e-m-f proteins, however, consist predominantly of L-amino-acids with bulky side-chains which can be disposed only in the *trans* configuration.

Secondly, within the k-e-m-f group itself, x-ray evidence, supported by elasticity data, distinguishes between the extended proteins of  $\beta$ -type (e.g. feather keratin) and the regularly-folded proteins of  $\alpha$ -type. These latter are the more widely distributed, for the  $\beta$ -keratins are largely an evolutionary development in the epidermal structures of reptiles and birds. The  $\alpha$ -types can in all cases be transformed to  $\beta$ -types, sometimes by the simple process of stretching, sometimes by more-complex techniques, and this transformation is reversible. The artificial  $\beta$ -keratins do not possess the complex, rich, large-scale pattern found in feather keratin.

Thirdly, the interpretation of the gross structure of  $\alpha$ - and  $\beta$ -keratins has been built up from many-sided evidence. The simplest picture that we can conceive for  $\beta$ -keratin is one in which the extended polypeptide chain is juxtaposed with another in the direction of the side-chains to form a sheet or grid; these latter are then built up into a crystallite by piling one sheet on another, the sheets being held together by attractions between the peptide bonds of neighbouring back-bones. The three fundamental spacings of the  $\beta$ -keratin pattern, 3.33 Å. in the direction of the fibre axis, and 4.65 Å. and 9.7 Å. at right-angles to it, are indeed those we would expect for the average amino-acid residue-length, back-bone and side-chain spacing respectively; but further, Astbury, the pioneer in these studies, proved that these last two spacings were at right-angles to each other. There is in addition much chemical evidence, again supported by elastic properties, that the main chains in keratin proper are cross-linked with disulphide bonds arising from cystine residues present in rather large amounts. This again suggests that side-chains of neighbouring polypeptides lie in the same plane.

With regard to  $\alpha$ -keratin, the structure proposed is rather more tentative. Assuming that the structure of  $\beta$ -keratin is correct, the problem is to formulate a folding of the grid such that five observed experimental premisses are upheld: (i) the fold is 5.14 Å. long and must comprise three residues; (ii) the  $\beta$ -form must be approximately twice as long as the  $\alpha$ ; (iii) the densities of  $\alpha$ - and  $\beta$ -forms must be the same; (iv) the integrity of the grid must be preserved on stretching,

i.e. the side-chains must not swing round the main chains but must maintain their general directions; and (v) there must be sufficient room for the side-chains. It seems significant that a simple fold, maintaining (iv), i.e., the folding of the grid in a direction at right-angles to the side-chain direction, can be made to fulfil the other requirements, and to reveal another probable feature—the close-packing of side-chains, which are disposed as triads on either side of the main chain (Astbury, 1941, 1942). In this we see at once a factor which endows the  $\alpha$ -form with great stability, since individual groups of each triad might possess strong attractions for each other, as between acid and base, or between paraffinic side-chains. This model of Astbury's cannot be considered final, but as a working hypothesis there seems no reasonable alternative.

In any more-detailed interpretation of the structure of  $\alpha$ - and  $\beta$ -keratins, we are on much more uncertain ground, whether it be in the detailed composition of the fold, or in the higher level of molecular organization which concerns the larger repeating units lying at the limit of resolvability by x-rays but potentially resolvable by electron-optics. Yet it is clear that, by comparison, what knowledge we have of the fibrous proteins surpasses that for the corpuscular proteins, where only in very recent times has a modest beginning been made in the elucidation of their architectural complexity.

#### 4. Interrelation of the Soluble Fibrous Proteins

##### a. General Similarities

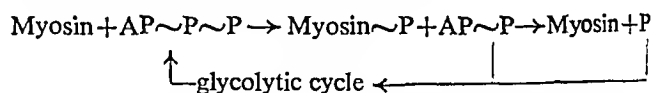
When the soluble members of the k-e-m-f group are compared, the similarities revealed by x-rays extend to physico-chemical, chemical, and biological properties (Bailey, 1944). Fibrinogen, myosin and tropomyosin all have globulin-like solubility, are salted-out at low ionic strengths, and have similar isoelectric points. When dried by mild methods, the  $\alpha$ -pattern is maintained, even where the process involves a loss of solubility or "denaturation". This is an important property and one distinguishing them from the corpuscular proteins, which usually pass to disoriented  $\beta$ -chains on denaturation. There is nothing to suggest that the transformation to the  $\beta$ -form plays any part in the biological role of these proteins. Purified fibrinogen, subjected to the action of thrombin, gives rise to an anastomosis of fibrin filaments which are also of  $\alpha$ -type (Bailey *et al.* 1943). In living muscle, the myosin filaments give rise to an  $\alpha$ -pattern which, surprisingly enough, is maintained during physiological contraction, where in fact we might expect a transformation indicative of a more folded form (Astbury, 1947). There are compelling reasons to suppose that if physiological contraction does involve an intramolecular folding of chains, this lack of disorientation is more apparent than real. X-rays pick out only the crystalline parts of the system, and during moderate contraction the less-crystalline parts will begin to fold first, so that disorientation is delayed. Such an effect is seen in the true keratins.

##### b. Significant Functional Similarities in Fibrinogen and Myosin

Whatever the detailed mechanism of clotting or of contraction, it seems likely from the nature of the processes that changes in the aggregation of the two proteins are concerned, and this is in keeping with the large numbers of polar groups

present. Recently, evidence has been obtained that the action of thrombin on fibrinogen is two-fold, involving the liberation of SH groups and subsequent re-forming of disulphide bridges between adjacent chains (Lyons, 1945). If this is so, it no doubt represents the trigger-mechanism for the aggregation of other side-chains. More important, perhaps, it suggests for fibrin the type of bonding which is accepted for wool and other keratins. These developments are made even more interesting by recent findings on the importance of SH groups in myosin, and their role in an interaction which gives rise structurally to something of the nature of a fibrin clot. To extend the analogy, we must digress to consider some of the properties of myosin.

After the isolation of myosin from the fibril, it soon became apparent from studies of flow-birefringence, elasticity, and x-ray diffraction, that the protein possessed all the fibrous properties which might be expected of the ultimate contractile mechanism, and the large amounts present in muscle supported the idea. The energy for contraction must clearly be derived from some reaction capable of building up the potential energy of the polypeptide chains. In point of time, it was known that the break-down of adenosine triphosphate (ATP), a substance containing two labile, energy-rich phosphate groups, was more or less coincidental with contraction, and the subsequent work of Liubimova & Engelhardt (1939) showed that purified myosin itself was capable of splitting ATP. Efforts to separate ATP-ase from myosin have failed, so that the linking of ATP as the direct energy-provider for the intramolecular contractility of the myosin filament seems probable, though the precise mechanism is obscure. The difficulty lies in the fact that the break-down of ATP to adenosine diphosphate and free phosphate cannot contribute to the potential energy of the protein chains, unless *in vivo* the phosphate is transferred to a protein side-chain or an end-group:



Side by side with the ability to split ATP, myosin *in vitro* interacts with another remarkable protein-component of the fibril, actin, first isolated by Straub (see Szent-Györgyi, 1945) and intensively studied by the Szeged school. Little is known of the nature of actin. The addition of actin to myosin results in a gelation due to the formation of "actomyosin", which in the electron-microscope is seen to be a highly anastomosed system of protein filaments, reminiscent of the structure of a fibrin clot (Perry & Reed, 1947). In very low concentration, ATP is capable of breaking up the system into its original components, and the viscosity falls. These phenomena cannot satisfactorily be fitted into a scheme of contraction except in a very speculative manner, and it seems wiser at the moment merely to record them. The interesting feature of the reaction, recently shown by Bailey & Perry (1947), is that the viscosity-increase occurs only if the SH groups of myosin are intact; if they are oxidized or substituted, the formation of actomyosin is prevented. Thus there appears to be a co-ordination of the actin with the SH groups of myosin, but on the actin side of the partnership, the groups responsible are unknown; they are not, however, SH or pyrophosphate groups. This SH property links a purely colloidal reaction of myosin with its ATP-ase activity, since this too depends upon the presence

of intact SH groups. Moreover, the extent of inhibition of actomyosin-formation runs parallel with the inhibition of ATP-ase activity as the SH groups are progressively substituted or oxidized (Bailey & Perry, 1947), and it would seem that the same groups are responsible both for enzyme activity and for the colloidal reaction. This receives independent support from the fact that ATP participates in both, and the mechanism of its action could be explained by a competition between actin and ATP for the active enzyme centres. By its ability to prevent actomyosin formation, the affinity of ATP for myosin must be very much greater than that of actin.

In the light of these facts, it is important to record that, in addition to other common properties of fibrinogen and myosin, SH groups play an important, even vital, role in their separate reactions. The importance of SS bonds in the structure of the true keratins needs no emphasis.

#### *c. Possible Relation of Myosin and Tropomyosin*

The recently discovered tropomyosin (Bailey, 1946) has been obtained in crystalline form from the skeletal muscle of the rabbit and whiting, and from pig cardiac muscle. It is thus of wide-spread occurrence, and all evidence suggests that it is a component of the fibril and not of the sarcoplasm. Though water-soluble after isolation, it is best obtained from ethanol-ether-dried mince by extraction with strong salt solution, indicating that in situ it forms a complex with some other protein and possibly with lipid. In salt solutions it exists as a homogeneous solute of molecular weight 90,000, but the removal of salt by dialysis results in an enormous increase of viscosity, due to the aggregation of molecules by electrostatic interaction into long fibres (300A. in width and 3000-6000A. long) which exhibit positive flow-birefringence. The ultimate molecule itself is highly asymmetric and composed of either one or two chains in the  $\alpha$ -configuration.

The mere fact that tropomyosin is the first protein of  $\alpha$ -type to be both crystalline and fibrous renders it of particular interest, quite apart from its possible function in muscle, which as yet is quite unknown. The properties of tropomyosin suggest that it may be a unit from which the myosin chains are in part elaborated. In all its physico-chemical properties, it is the prototype par excellence of myosin itself, and is built on the same intramolecular plan; its method of preparation suggests an intimate connexion with the structural proteins of the fibril. If the role we have suggested for tropomyosin is correct, it is difficult to answer why it exists free at all, except to note that nothing whatever is known of the mechanism of protein synthesis. There is the indirect evidence that in strong urea solutions myosin does in fact depolymerize to units of the size of tropomyosin, a process which affects only the secondary valence forces and not covalent bonds of the polypeptide chain. From a common-sense point of view, it seems almost impossible that a filament of the dimensions of the myosin particle can be rolled off fully-fashioned from its template, but more probable that, as in the transformation of fibrinogen to fibrin, it is built up from smaller units. We have also the example of the interaction of one tropomyosin molecule with another to give a fibrous product and of the further interaction of myosin and actin to give a highly aggregated complex. The supposition, then, that protein fibres are built initially by interaction of fairly large units signifies more than an intuitive belief.

If the analyses of myosin and tropomyosin were identical, the hypothesis would be unshakeable. In actual fact, they are very similar in certain respects: in the high lysine and arginine, and low histidine contents; in the amounts of tyrosine, leucine, valine, proline, methionine, serine, and the very high contents of glutamic acids and identical amounts of aspartic acid. Altogether, both molecules are the most polar (of mixed valency type) that have been encountered. There are differences, however, which leave no doubt that myosin is not built solely from tropomyosin units, even allowing for the fact that a "pure" myosin has not been analyzed. Differences are found in the relative amounts of certain amino-acids and in the absence of tryptophan and glycine from tropomyosin. This is a discouraging aspect in elucidating the relation of the two proteins and complicates, rather than denies, the hypothesis, for it represents but one example of a more general problem.

#### 5. Chemical Make-up of Interrelated Proteins

As we pass from keratin to myosin, it is difficult to see any similarity in chemical composition; in other words, the  $\alpha$ -fold can be maintained in spite of chemical differences. Astbury has attempted to explain this fact by assuming that whole groups of amino-acids are important rather than individual amino-acids. In particular, he has suggested that k-e-m-f proteins possess an alternation of polar and non-polar groups along the chain, which, by reference to the  $\alpha$ -model, gives rise to an alternation of triads, all polar on one side of the chain, and non-polar on the other (Astbury, 1941, 1942). Such an arrangement would endow the  $\alpha$ -form with the elastic properties which in fact it possesses. This formulation cannot strictly be upheld, since it implies that in the k-e-m-f proteins, the polar groups must comprise 50 % of the total; the figures for wool, fibrin, myosin and tropomyosin are 45 %, 54 %, > 57 % and 63 %, respectively.

Here, then, we reach something of an impasse in the finding that the  $\alpha$ -fold can exist in spite of, and sometimes by the similarity of, the amino-acid make-up, and other avenues need to be explored. As a general problem, arising from considerations of the stoichiometry of proteins, Astbury has discussed the possible ways of realizing residue interchange (Astbury, 1943). Either there may be a sequence of certain types of residues allotted to definite sites, thus giving rise to a stoichiometry of types and not of individual residues; or there may be a variable grouping of chains or even of grids of constant composition. The arguments presented in the case of myosin and tropomyosin would favour the latter idea, which also finds support from recent work on corpuscular proteins. There is both physical and chemical evidence that many proteins consist of more than one polypeptide chain. They may depolymerize in urea, in slightly acid or alkaline solutions, in very dilute aqueous solution, and contain  $\alpha$ -amino groups capable of chemical reaction and marking the terminal acid of each separate polypeptide chain. In the case of insulin, the sub-molecules of molecular weight 12000 contain 4 peptide chains, one pair of which differs from the remaining pair in end-groups and in amino-acid composition (Sanger, 1945). Is this then the key also to the chemical variations in the k-e-m-f group? If so, it implies that several types of sub-unit are characteristic of the  $\alpha$ -proteins, and these are brought together in varying proportion to serve particular ends; it implies too that

*Continued at foot of page 342*

## SOME NEWER KNOWLEDGE OF PLASMA PROTEINS

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- 1 Ultracentrifugal studies
  - 2 Electrophoresis
    - a Normal plasmas
    - b Pathological plasmas
    - c Antisera
  - 3 Bulk fractionation of human plasma-proteins with solvents
  - 4 Clinical application of plasma-fractionation products
- References

The past few years have seen such intensive study of the plasma-proteins, and the information accumulated is so extensive, that a short review can indicate only a few salient features. The outburst of activity may be attributed predominantly to the refinement of the technique of electrophoresis, and to the combination of the precise data so gained with that from physiological, pathological and immunological investigations. By the early 1930's, a considerable bulk of data relating to the plasma-proteins was available, as a result of studies on "salt-out" and solubility, in conjunction with osmotic pressure and, latterly, ultracentrifugal studies.

Before proceeding to the discussion of more recent data, it may be of value to summarize broadly the position at that time.

Three types of protein were distinguished in plasma: fibrinogen, globulin and albumin. It is in this order that these proteins precipitate from plasma as the concentration of neutral salts, such as ammonium sulphate, sodium sulphate or sodium phosphate mixtures, is progressively increased, either by the addition to the plasma of saturated solutions of the salts, or by the direct solution of the solids in the plasma. Inflections in the curves relating the amount of protein precipitated to the concentration of added salt were utilized in attempts to establish the individuality of the components, and also in the development of methods of separating one from another. Two other main variables, pH and temperature, gave added flexibility to the preparative procedures. Similar techniques were used in the examination of the deviations from the normal distribution which were found to occur in pathological conditions, during the course of immunization procedures, and also for the isolation from plasma of protein fractions associated with specific biological activity.

Fibrinogen was sharply distinguished from the other plasma-proteins by its property of forming a fibrin clot as a result of the enzymic activity of thrombin. Albumin had been obtained in crystalline form from some species, and though relatively well defined, was already succumbing to subfractionation. The complexity of the globulin fraction had long been evident. It had been subfractionated into pseudoglobulin, a water-soluble portion, and euglobulin, a portion insoluble in the complete absence of salts, but soluble in dilute salt solutions. The order of molecular weight of these fractions was known, in some cases with a high degree of accuracy as a result of osmotic-pressure determinations.

This, briefly, was the general situation, though an enormous background of detailed information was also available.

### FIBROUS PROTEINS

*Continued from page 341*

Astbury's limiting or ideal in just this way, with keratin, tropomyosin at the other; it is not identical. It must be obvious that the attention must be group either biogenetically, biologically or chemically.

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## 1. ULTRACENTRIFUGAL STUDIES

When a protein solution is subjected to an intense centrifugal field, the molecules sediment at a rate which depends on four factors: the mass of the molecule, the difference of density between the protein and solvent, the viscosity of the solvent, and the centrifugal field strength. The sedimentation velocity in unit field, corrected to standard solvent conditions, is designated the sedimentation constant, and is a characteristic of the molecule.

In the early 1930's, the effectiveness of the analytical ultracentrifuge was widely extended by the introduction of the Lamm-scale method for optical observations, by which the changes in refractive index associated with the boundary of a sedimenting protein could be accurately delineated (Svedberg & Pedersen, 1940). With this improvement it was possible, in addition to measurements of sedimentation constant, to obtain a measure of the homogeneity of the protein under examination. Further, in a mixture of proteins with differing sedimentation constants, an analysis of the quantities of the separate components present could be made, subject to certain reservations.

Using this method it was shown that the proteins of plasma were distributed into two chief groups of differing sedimentation constant. A comparison of the data from whole plasma with that obtained on derived salt-fractionated preparations showed that the sedimenting components corresponded with globulin and albumin, with respective sedimentation constants of about 7.0 and  $4.5 \times 10^{-13}$ .

By combination with the respective values for the diffusion constants, determined by the method developed by Lamm, the following molecular weights were derived, for globulin c. 170,000 and for albumin 70,000.

Though the sedimentation and diffusion constants are a function of molecular weight, their precise values are also dependent on the shape of the molecule. Recent measurements indicate that, although the molecular weight of fibrinogen is in the region of 600,000, owing to the elongated form of the molecule its sedimentation constant is so close to the more nearly spherical globulin molecule, that resolution does not occur in the ultracentrifuge. On this account the separate existence of fibrinogen in plasma is not demonstrable by ultracentrifugal studies.

In the plasma of some species small amounts of proteins of very high molecular weight occur, notably in the horse and pig; these appear as separate components in ultracentrifugal analyses and behave as globulins in their solubility relations.

## 2. ELECTROPHORESIS

In 1937 the initial data obtained with the improved electrophoresis apparatus devised by Tiselius were published (Tiselius, 1937). In addition to providing qualitative information about the number of components present in complex protein solutions, and precise values of their respective mobilities, the apparatus was adapted to the isolation of electrophoretically-homogeneous proteins in small quantities from mixtures.

The original simple "Schlieren" optical system used with the apparatus, though capable of indicating the presence of several components, gave no measure of the quantities in which they occurred. The Lamm-scale method was used to a limited extent, but owing to its laborious nature it was

quickly superseded by other methods, notably the "Schlieren scanning" and "diagonal Schlieren" systems, each of which provides quantitative data (Abramson, Moyer & Gorin, 1942).

The migration of a dissolved protein in an electric field is primarily determined by the net charge of the molecule, and since this is predominantly derived from the ionization of basic and acidic groups, it is in its turn a function of the pH and salt-content of the medium in which the protein is dissolved. Electrophoretic phenomena are therefore more closely related to the chemical structure of the molecule than sedimentation, which depends chiefly on size and shape.

From a mixture of proteins an electrophoresis-pattern is obtained in which each component gives rise, as in the ultracentrifuge, to a separate peak, closely allied to a normal distribution curve. This is subject to the migration having continued for a sufficient period under suitable conditions.

### a. Normal Plasmas

In his original examination of horse serum at pH 8, Tiselius (1937) distinguished four components. That with the highest mobility was identified as albumin, the remaining three as globulin, and designated  $\alpha$ ,  $\beta$  and  $\gamma$  in descending order of mobility. The more recent examination of human plasma indicates that six components are present: albumin,  $\alpha$ -globulin which, under special conditions, splits into  $\alpha_1$  and  $\alpha_2$ ,  $\beta$ -globulin, fibrinogen and  $\gamma$ -globulin in order of mobility (Longworth, 1942).

The quantitative constitution of normal human plasma determined by electrophoretic analysis, in which each component is given as a percentage of the total protein, is as follows (Edsall, 1947):—albumin 55; globulin  $\alpha$  14;  $\beta$  13.5;  $\gamma$  11; fibrinogen 6.5. These proportions remain remarkably constant in the normal individual, as the agreement between determinations in laboratories in many countries has shown.

The plasma of other species shows qualitative and quantitative electrophoretic deviations from normal human plasma with respect to the number, amount and mobility of the components. For example, in the horse the  $\beta$ -globulin is represented by two components  $\beta_1$  and  $\beta_2$ , and in the dog the pattern appears to be even more complex.

It may be of interest to point out the relation of the pseudo- and euglobulin fractions to the electrophoretic components. Both of these are mixtures; in pseudo-globulin the  $\alpha$ - and  $\beta$ -globulins predominate, whilst in euglobulin the chief constituents are  $\beta$ - and  $\gamma$ -globulins.

In human plasma, most of the protein-bound lipid is associated with the  $\alpha$ - and  $\beta$ -globulins. The albumin does not appear to have any carbohydrate attached to it, and in this respect differs from horse-serum albumin.

Although the plasma-components revealed by electrophoresis display a reasonable degree of electrochemical homogeneity, it is important to appreciate that this does not imply absolute chemical or physiological homogeneity. The wide range of physiologically- and immunologically-active proteins detectable in plasma is apposite to this point, and also the fact that the electrophoretically-homogeneous components are susceptible to further fractionation by solubility-methods. Further, the activity of proteins associated with specific biological effects is frequently so high in relation to mass, that the quantities present in plasma may

be far below the power of resolution of the electrophoresis-apparatus.

### b. Pathological Plasmas

The plasma and serum from a large number of pathological conditions have been subjected to electrophoretic analysis and already a considerable literature exists. To discuss the findings related to specific diseases would require detail beyond the scope of this article. In general, the quantitative distribution of the components has frequently been found to diverge, sometimes very markedly, from the normal. It appears to be exceptional for an entirely new component to appear in such plasmas.

In febrile conditions the proportion of  $\alpha$ -globulin is usually enhanced, whereas in nephrosis the albumin content is very low and the  $\beta$ -globulin is increased to a remarkable extent. Several conditions are associated with increases in the  $\gamma$ -globulin, notably cirrhosis of the liver and multiple myelomatosis, though in the latter abnormally high  $\beta$ -globulin contents may be found (Abramson *et al.* 1942). In infectious conditions there is also a tendency for the  $\gamma$ -globulin to be increased which is consistent with the finding that many antibodies are associated with this component.

This brief summary discloses that the changes occurring in the plasma-protein distribution in pathological conditions are not specifically related to any one disease. It is possible that the correlation of the clinical course of various diseases with alterations in the electrophoretic patterns may prove valuable in the assessment of therapeutic measures.

### c. Antisera

In the production of therapeutic antisera, the horse is most generally utilized. In this animal the antibacterial antibodies appear to be associated with  $\gamma$ -globulin which in hyperimmune serum is often very much increased in amount. In antitoxic sera the occurrence of two antibodies has been demonstrated, one associated with the  $\beta$ - the other with  $\gamma$ -globulin, and also differing from one another in certain biological characteristics. In the rabbit, antibodies appear usually in the  $\gamma$ -globulin (Abramson *et al.* 1942).

## 3. BULK FRACTIONATION OF HUMAN PLASMA-PROTEINS WITH SOLVENTS

Although, as already mentioned, it is possible to isolate the individual proteins from human plasma by electrophoresis, the scale on which this can be accomplished is very limited, and from this point of view the method is useful only on a research basis. In conjunction with bulk-fractionation methods, the apparatus has proved of inestimable value in providing an independent means of controlling and assessing improvements in the resolution of fractionation-procedures.

The separation of proteins has generally been carried out in very concentrated salt solutions, in the region of 2–3 molar, a procedure which has two main disadvantages. Firstly, high salt-concentrations mask specific salt-protein effects which may be utilized in improving the resolution of separations. Secondly, the products must be freed from the

precipitating salt by dialysis, a procedure difficult to carry out under the aseptic conditions desirable if the product is required for clinical purposes.

In attempting to separate proteins in a relatively pure condition from a mixture in aqueous solution, there are several variables which can be used to establish conditions such that a desired protein can be caused to precipitate more or less completely, leaving others in solution. The following are the determinant variables: pH, salt concentration, temperature, total protein concentration—and, as a result of recent studies, solvent concentration.

If a solvent is used to reduce the solubility of a protein, the electrolyte-content of the system can be maintained in as low a concentration-range as may be necessary. It is simpler to maintain aseptic precautions when adding solvents: indeed those solvents suitable for precipitation purposes tend to be bacteriostatic. Finally, the solvents can be removed from the products by freeze-drying, an operation easily performed under sterile conditions. The one disadvantage of solvents lies in their tendency to cause denaturation and loss of biological activity in proteins at room-temperature, and their use necessitates processing at temperatures ranging from 0° to –10° C. The precise examination of such methods has largely been due to E. J. Cohn and his associates, though sporadic papers have appeared in the literature as far back as 1908 (Cohn *et al.* 1946).

Such investigations were stimulated by the urgent needs of war and were initially directed towards the production of a stable liquid transfusion-material. This presents certain advantages over freeze-dried plasma, although under proper conditions the latter retains its properties for an indefinite period. Normal human citrate-plasma on storage tends to clot, and even if the fibrinogen is removed, precipitates form which simulate bacterial infection. These precipitates derive from the breakdown of complexes formed by lipoids with the plasma-globulins. In the production of a stable liquid transfusion-material from human plasma, two methods of attack are possible. The fibrinogen and globulins may be removed entirely, providing a stable solution of albumin. Alternatively, the fibrinogen and unstable lipoids may be removed from the plasma and the whole of the remaining proteins made available. The former method was followed in the USA, and in Britain the latter was explored.

The system of fractionation of human plasma with ethanol at low temperature developed by E. J. Cohn and his colleagues (Cohn *et al.* 1946) was primarily aimed at the preparation of pure human serum-albumin for transfusion. As the work progressed, a secondary objective developed: to separate the plasma-proteins into a limited number of main fractions corresponding as closely as possible to the individual electrophoretic components. These main fractions then provided the basis of various subfractionations, oriented with reference to specific biological activities. The following purified materials were made available in quantities and at concentrations adequate for clinical purposes: albumin, fibrinogen, thrombin,  $\gamma$ -globulin and erythrocyte isoagglutinins.

By the use of ether in the fractionation of human plasma, fibrinogen, thrombin, globulin concentrates and a stable delipoided transfusion-fluid have been made available in Great Britain (Kekwick, Record & Mackay, 1946).

#### 4. CLINICAL APPLICATION OF PLASMA-FRACTIONATION PRODUCTS

Perhaps the most versatile of the products of plasma fractionation are fibrinogen and thrombin (Bailey & Ingraham, 1944). Since the clotting-time of fibrinogen-thrombin solutions can be accurately controlled, a liquid mixture, which subsequently clots, can be applied locally. The tensile strength of fibrin clots, though also a function of other variables, increases with fibrinogen concentration, and solutions of fibrinogen up to ten times (2%) the corresponding concentration in plasma are readily attainable. The clots formed from such solutions have been used to suture severed nerves by a process of "soldering". Rather lower concentrations of fibrinogen provide, with thrombin, an excellent adhesive for the application and fixing of skin grafts, dispensing with the necessity for pressure dressings. Grafts fixed in this manner vascularize with extraordinary rapidity, and the tendency to bronze pigmentation appears to be reduced.

Fibrin films, resembling sheet cellophan in appearance, have been successfully used as dural substitute with marked absence of adhesion. The film is eventually replaced by fresh dural growth.

Somewhat less purified fibrinogen solutions are utilized in the production of fibrin foam. By suitable devices, these solutions are beaten to a finely dispersed foam which is "set" by adding thrombin and then dried from the frozen state. Such foams if rewetted tend to shrink rapidly, but

this can be prevented by baking the dried foam at 130° to 170° C. The dried foam will absorb almost its own volume of thrombin solution, and is used in conjunction with this for local haemostasis in internal surgery. The foam is allowed to remain in situ following operative procedures, and eventually becomes organized into the tissue without scar-formation.

It has been established that the antibodies in many infectious diseases are associated with the  $\gamma$ -globulin of normal adult plasma (Enders, 1944; Stokes, Maris & Gellis, 1944; Ordmann, Jennings & Janeway, 1944). Concentrates of this protein containing 15 g. protein/100 ml. have been very successfully used in the control of measles, and may be useful in infectious hepatitis. For measles, intramuscular injections up to 5 ml. are required. The use of similar concentrates prepared from convalescent-plasma pools from other infectious diseases, for example, mumps, has been examined.

The A and B isohaemagglutinins, which appear to be associated with  $\beta$ -globulin, have been purified and concentrated from pools of plasma of suitable blood-group. High-titre sera are required for accurate blood-group testing, and concentration methods make available the agglutinins from plasmas whose titre initially is too low.

Purified albumin solutions containing 25 g./100 ml. have been satisfactory for transfusion in cases of shock and hypoproteinaemic oedema.

Further research may indicate the clinical usefulness of other fractions derived from human plasma.

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## AMINO-ACIDS IN NUTRITION

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- 1 Endogenous and exogenous metabolism of protein
  - 2 Protein storage
  - 3 Regulation of protein metabolism
  - 4 Clinical symptoms of specific amino-acid deficiencies
- References

Protein metabolism in general has been fully discussed in this journal in 1944 by Cuthbertson<sup>1</sup>, and the effect of protein on convalescence, recovery from injuries and burns has been considered by Peters<sup>2</sup> (1945) and Cuthbertson<sup>3</sup> (1945) respectively. It is not the purpose of this essay to bring these reviews up to date, but rather to consider some general problems of protein metabolism, to indicate gaps in our knowledge and to discuss possible future lines of work.

### 1. Endogenous and Exogenous Metabolism of Protein

Those early workers, such as Liebig, Boussingault, Voit and Pettenkofer, who introduced exact methods into the field of protein metabolism, were greatly impressed by the fact that the adult mammalian organism tends to keep its protein-content constant under the most diverse dietary conditions. Thus, a large increase of protein-intake leads after a very short lag to a corresponding rise in urinary N excretion, whilst starvation or a specific protein-deficiency produces a very marked reduction in N output. We know now that a similar regulation occurs in the metabolism of water and electrolytes. Voit (1866) suggested as an explanation that the protein molecules which form part of the living structure were metabolically almost inert, whilst the "storage protein" which was derived from the nitrogen present in the diet and which was assumed to circulate freely in the tissue-fluids was readily catabolized. This theory was further elaborated in a later publication (Voit, 1881) and has dominated reasoning in this field up to the last decade. Voit did not make it clear whether the differences which were supposed to exist between "tissue protein" and "circulating protein" were of a chemical or physical nature. He admitted that there may be an interchange between these two classes of protein, but emphasized that such reactions must be very slow. Rubner, who contributed a large amount of experimental work and a possibly disproportionate volume of speculative writing to the development of this field, investigated N excretion in subjects supplied with their full caloric requirements but lacking protein completely. The constant and small N

output observed under these conditions was ascribed to the slow rate of metabolism of the "living" or "tissue-protein". This "wear and tear" quota was assumed to be independent of dietary changes (Rubner, 1908; 1911).

The next important step in the development of this theory was taken by Folin (1905). This author compared changes in the composition of urine with the level of protein in the diet, and found that, whilst the concentration of some constituents such as urea was proportional to N intake, the excretion of other substances like creatinine was not influenced by variations in the diet. Folin suggested that the concentration of substances of the second group is a measure of the "endogenous" metabolism of the "tissue proteins" of Voit and is related to the "wear and tear" quota of Rubner. Excretion of urea and sulphate on the other hand corresponds mainly, but not exclusively, to the breakdown of excess dietary protein, and is related to "exogenous" metabolism. Thus Folin's extension of Voit's fundamental concept consisted mainly in relating the two branches of protein metabolism to certain nitrogenous substances in urine. However, Folin differed from Voit in one important point—he believed that the dietary protein is hydrolyzed to amino-acids and that these compounds of low molecular weight are mainly directly oxidized, without being first incorporated into "circulating protein".

Although the Voit-Folin theory was almost universally accepted, there have been a few dissentient voices. Thus Pflüger (1893) maintained that protein after absorption becomes quickly incorporated into the cell-structure and partakes in the general metabolic reactions of the organism. Much later Borsook & Keighley (1935) stated their belief that the sharp distinction between endogenous and exogenous metabolism was unjustified. However, the experimental evidence produced was not convincing, and it was only when isotopes were introduced into protein biochemistry by Schoenheimer, that the classical concepts had to be revised (for reviews see Schoenheimer & Rittenberg, 1940; Schoenheimer, 1946). Schoenheimer, Rittenberg and their colleagues used N<sup>15</sup> to mark the amino-acids or ammonium salts introduced in the diet, and followed the fate of the nitrogen atom in the organism. It was found that only a fraction of the labelled element was excreted in the urine; most of the nitrogen was found in the tissues. In fact, it may be inferred that all cells, even those of connective tissue and muscle, which had been thought to be particularly inert, are in a state of dynamic equilibrium with the nitrogenous compounds supplied in the diet.

Thus the old idea of Voit that the "tissue protein" is inert, and the modified theories of Rubner and Folin which assume that the protein turn-over of the body-substance is represented by the N excretion on a protein-free diet, are equally incorrect. Instead, we have to assume that the catabolic and anabolic reactions take place at a great speed and are fairly well balanced. Urinary N represents, therefore, only a small difference between the amounts of protein broken down and synthesized every day. However, the experimental facts on which the old theories were based need to be reconsidered, and it can be shown that the terms "endogenous" and "exogenous" metabolism can still be usefully employed, provided that their definition is adjusted to modern requirements.

In the old concept of Voit and Folin it was assumed that the terms endogenous and exogenous represented physical

<sup>1</sup> [BMB 486]    <sup>2</sup> [BMB 688]    <sup>3</sup> [BMB 691]

realities, i.e., the expressions were used to describe the actual fate of a metabolite in the body. Such an interpretation is now untenable, but the terms can still be used to describe items on a balance-sheet. Endogenous nitrogen has an exact physical meaning, if applied, for example, to the excretion of nitrogen on a protein-free diet, but if used in calculations of nutritional efficiency with protein-containing diets it represents, in general, nothing but a convenient fiction of nutritional accountancy. In certain cases a more precise meaning can be attached to the old terms. The excretion of creatinine in the urine is remarkably constant for any one individual in the absence of disease and is not markedly influenced by changes in the diet. The urinary creatinine is formed from the creatine-phosphate which is present mainly in muscle. Creatine in its turn is produced from arginine, glycine and methyl-donors, which all occur in the diet. Thus, the ultimate source of the carbon and nitrogen of creatinine, like that of urea and amino-acids, is largely exogenous. The difference between the two classes of compounds lies not so much in the nature of the different reactions involved, but in their rates. Creatine is formed in the body and creatinine is excreted in the urine at rates little influenced by the supply of precursors. Moreover, all the various reactions appear to be irreversible. The urinary creatinine may thus be endogenous in the sense that the amount formed is proportional to the mass of muscular tissue and is not related to the N content of the diet.

A somewhat similar position may exist with proteins. Schoenheimer & Rittenberg (1940) have shown that different organs vary greatly with respect to rate of N exchange. Further work is likely to show that different proteins, even in the same organ, are not metabolically active to the same extent. Thus, there will be some species of proteins which have a very high turn-over rate and correspond to the "circulating" protein of Voit. The same proteins may also increase in amount, if the intake of nitrogen is raised. Other types of protein molecules may be relatively inert and not quickly responsive to changes of diet. Such substances would represent the "tissue-protein" of Voit. Thus, these old terms may be used to describe not so much sharp qualitative differences between proteins, but quantitative variations in the rates of N exchange which are susceptible to unknown regulating factors. How far such differences are reflected in the chemical structures of the different proteins, only further research can show.

The use of labelled elements has not yet solved, but only shifted, the classical problems of protein metabolism. Are the rates of catabolic and anabolic reactions influenced by starvation, the N level in the diet, hormones, or specifically by some amino-acids? And above all, by what mechanism is the protein content of the body kept constant within fairly narrow limits in spite of the large changes taking place in the tissues? These are problems which can be tackled only with the aid of labelled elements.

## 2. Protein Storage

The assumption which has been made in the preceding section, that the N content of the adult organism tends to remain constant, is not wholly correct. It has been shown for man that superimposition of extra protein on a diet adequate for maintenance of body-weight and N equilib-

rium leads to marked retention of N (Cuthbertson, McCutcheon & Munro, 1937), and a similar result was produced by feeding carbohydrate (Cuthbertson & Munro, 1937). The storage of protein in the adult animal has recently been reviewed by Kosterlitz & Campbell (1945) who have themselves made important original contributions to our knowledge in this field. They have found that a fraction of liver-cytoplasm comprising protein, ribonucleic acid and phospholipin is quickly lost on reduction of protein below a certain level, or somewhat less readily by caloric restriction. This labile liver-cytoplasm is quickly regained if the protein intake is again raised above minimum requirements. Similar changes in other organs may occur, but they have been less carefully investigated. Another approach to the problem of protein storage has been made by Munro & Chalmers (1945). The work of Cuthbertson had shown that after injury, both in man and laboratory animals, there is an increase in the excretion of nitrogenous substances in the urine. This excessive excretion is reduced if the protein content of the diet is decreased, and becomes very small and transient on a protein-free diet. It thus appears that the well-fed organism has certain labile protein-reserves which are readily lost on injury. The amount of N lost is too large to be entirely accounted for by the labile liver-cytoplasm. The location of this reserve is unknown and it is also uncertain whether both this fraction and the labile liver-fraction differ chemically from the ordinary protein components of cell-cytoplasm. It is quite likely that they are again only items on a balance-sheet, and that their accumulation and mobilization are regulated by some unknown mechanism which is very sensitive to changes in the dietary intake of calories and protein.

The amounts of amino-acids and peptides present as such in tissues are small and are, quantitatively at least, unimportant as far as N storage is concerned. However, relatively large amounts of the tripeptide, glutathione, are present in all organs, but especially in the liver. The concentration of this peptide in the liver can be influenced within very wide limits by the composition of the diet (Leaf & Neuberger, 1947), and especially by its content of cystine and methionine.

## 3. Regulation of Protein Metabolism

The dynamic state of the body-constituents, as revealed by the isotope method, implies that oxidative, reductive and other reactions associated with large changes of free energy occur at a rate much greater than is indicated by the over-all energy-requirements of the organism or by the actual amounts of end-products excreted in the expiratory air and in the urine. It follows that reactions leading to a loss of free energy are coupled with those in which a net gain of free energy is produced. The question therefore arises as to how the relative constancy of basal metabolism, basal N excretion and N balance of the adult organism is ensured. It is at present impossible to answer these questions satisfactorily. It can be assumed that factors such as oxygen-tension, cellular concentrations of the various enzymes and coenzymes, and also those of the free amino-acids, influence the rates of the different catabolic and anabolic reactions which constitute protein metabolism. But there is evidence that, apart from these local cellular factors, hormones



may affect directly or indirectly the rate of reactions in which amino-acids take part.

It has been known for a long time that administration of thyroid increases N excretion. This effect may possibly not be specific but may result from the general stimulation of tissue oxidation. It is known that the "endogenous" N excretion is proportional to the basal metabolism, which is raised in hyperthyroidism. Recent American work has shown that androgens, especially testosterone, produce N retention in castrates, and similar results have been claimed for oestrogens. Moreover, both catabolic and anabolic effects on protein metabolism have been produced by the various steroids found in the adrenal cortex. Nothing is known about the way in which these substances act. One possibility is that at least some of these steroids, i.e., those lacking a hydroxyl group in position 11, act not directly on protein metabolism but indirectly through their effect on the excretion of sodium and potassium. Recent work of Hastings and others (see e.g. Hastings & Buchanan, 1942) has shown that various enzyme-reactions are greatly influenced by the ionic composition of the medium. It is thus quite likely that the rate of protein synthesis is affected by the concentration of sodium and potassium, respectively, and any hormone which regulates the excretion of these cations by the kidney may have an indirect influence on protein metabolism. The other group of biologically-active steroids of the adrenal cortex may affect protein metabolism through their action on carbohydrate oxidation.

More is known about the relationship between the pituitary and N excretion. It has been known for some time that the growth-hormone stimulates N retention. Part of this effect is undoubtedly due to the increased appetite which results from the administration of this hormone. But it has been shown in paired-feeding experiments, in which the controls received a diet of caloric value equal to that given to the animals injected with pituitary extracts, that increased growth occurs even under conditions of caloric restriction (Lee & Schaffer, 1934). Recent work by Young (1945) has fully confirmed these results; it was demonstrated that administration of pituitary extract to various animals, kept on diets which under normal conditions were just sufficient to maintain body-weight, produced N retention and, in the cat and dog, diabetes. The caloric requirements of these animals were largely covered by the combustion of fat, and this enabled the animal to retain N in spite of caloric restriction. Young suggests that this action on N balance is associated with the diabetogenic activity of these extracts. This may mean that the pituitary influences growth largely through its effect on carbohydrate oxidation. Some information is available which suggests that insulin enhances N retention, but further work on this point is required before the mechanism can be considered fully established.

The protein-sparing action of carbohydrate has been known for some time, and it has been generally assumed that this resulted from a purely energetic replacement of protein by carbohydrate. In other words the combustion of carbohydrate released a calorically-equivalent amount of protein for purposes of growth and tissue-regeneration.

But there is an alternative explanation. Various reversible and irreversible reactions in which amino-acids are concerned produce  $\alpha$ -keto-acids, many of which are associated with the metabolism of carbohydrates. Indeed, the keto-acids which correspond to those amino-acids which, according to isotope experiments, show the fastest turnover-rate—such as aspartic and glutamic acid—are most closely linked with the oxidation of glucose. It is thus possible that the protein-sparing action of carbohydrate may be due to the fact that glucose provides precursors of non-essential amino-acids, and that ammonia is then utilized for amino-acid synthesis instead of being converted into urea. In the absence of insulin, oxidation of glucose is inhibited, and the ammonia liberated in intermediary reactions is lost for purposes of protein formation.

#### 4. Clinical Symptoms of Specific Amino-acid Deficiencies

The essential amino-acids, i.e., those nitrogenous compounds which the mammalian organism cannot synthesize from substances normally present in the diet, have often been compared to vitamins. There are, however, important biological differences between these two groups of essential metabolites. Although complex interrelationships exist between certain vitamins, in general the requirements for various vitamins are largely independent of each other and additive. Moreover, many vitamins can be stored as such in the body. On the other hand, the formation of protein can proceed only if all the essential amino-acids are provided in the diet; single amino-acids can be stored only in insignificant quantities. It is therefore not surprising that, apart from exceptions to be discussed below, deficiencies of single amino-acids produce a clinical picture which is not specific for any one compound. What is generally observed is cessation of growth, loss of weight, hypoproteinaemia and a relatively mild anaemia. The animals get adapted, to some extent, to the lack of protein by reduction of N output to a minimum and by losing protein first from the non-essential organs. Such animals appear to be less resistant to infection, possibly due to interference with antibody production.

The position of the sulphur-containing amino-acids, methionine and cystine, appears to differ from that of other essential amino-acids. Methionine is, apart from being building-material of proteins, a donor of methyl-groups for the synthesis of choline and other substances. Cystine is a precursor of glutathione, of taurine and possibly other compounds of low molecular weight. It is therefore not surprising that a deficiency of these amino-acids produces more-specific clinical symptoms. With young rats, feeding of amino-acid mixtures lacking these sulphur-containing compounds produced an acute hepatic necrosis which could be prevented by the addition of either cystine or methionine (Glynn, Himsworth & Neuberger, 1945). However, later work has indicated that it is necessary for the production of necrosis to remove from the diet, not only these two amino-acids, but also tocopherol. The exact mechanism of the causation of these liver lesions is therefore still obscure.

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DR. MARJORY STEPHENSON is director of the Medical Research Council's Unit for Chemical Microbiology in Cambridge. Dr. Stephenson, who is a Fellow of the Royal Society, has worked for many years on problems of bacterial enzyme chemistry and is the author of *Bacterial metabolism*, the well-known textbook on the subject, as well as of a series of papers published mainly in the *Biochemical Journal*. The main trend of her work has been the study of bacterial enzymes, with a view to elucidating problems of growth and adaptation. She has recently been appointed Reader in Microbiological Chemistry in the University of Cambridge.

DR. E. F. GALE is a member of the scientific staff of the Medical Research Council and has worked in the Council's Unit for Chemical Microbiology at Cambridge for some years on the amino-acid metabolism of bacteria. He worked out the conditions necessary for the production of amines by bacteria and (with Epps) first obtained the amino-acid decarboxylases in a cell-free state; these investigations eventually led to the identification of pyridoxal phosphate as the prosthetic group of these enzymes. He is now studying the assimilation of amino-acids by bacteria and the effect of chemotherapeutic agents, particularly penicillin, on the processes involved. Publications: "Bacterial amino-acid decarboxylases" (*Advances in Enzymology*, 1946, 6, 1); *The chemical activities of bacteria* (University Tutorial Press, 1947); papers in *Biochemical Journal* and *Journal of General Microbiology*, etc.

DR. D. D. WOODS read biochemistry at Cambridge and worked there for a number of years on problems of bacterial metabolism in Dr. M. Stephenson's

unit. For part of this period he held a Beit Memorial Fellowship. In 1939 he joined the Medical Research Council Unit for Bacterial Chemistry (under Sir Paul Fildes) and in 1940 published his observations on the relation of *p*-aminobenzoic acid to the mode of action of the sulphonamides (*Brit. J. exp. Path.* 1940, 21, 74) which were the basis of an hypothesis concerning the fundamental biochemical action of these drugs which is now widely accepted. For the greater part of the war Dr. Woods was on the staff of the Microbiological Research Department, Porton. He is now Reader in Microbiology in the Department of Biochemistry, University of Oxford and is continuing his work on the biochemical aspects of sulphonamide action and related subjects. Dr. Woods is on the editorial staff of the *British Journal of Experimental Pathology* and the *Journal of General Microbiology*.

PROFESSOR R. A. PETERS has previously contributed to the Bulletin a paper on "The biochemical lesion in thermal burns" (*BMB* 688), with which a note on his work was published.

PROFESSOR R. H. S. THOMPSON was educated at Trinity College, Oxford, and Guy's Hospital Medical School. Holding the Adrian Stokes Travelling Fellowship, he worked from 1937 to 1938 in the Hospital of the Rockefeller Institute for Medical Research, New York. In 1938 he was awarded the Gillson Research Scholarship in Pathology by the Society of Apothecaries of London. Since 1938 he has been a Medical Fellow of University College, Oxford and Demonstrator in Biochemistry, Oxford. From 1939 to 1944 Professor Thompson was a member of the Extra-mural Research Team, Chemical Defence Research Department, Ministry of Supply, under the direction of Professor R. A. Peters, who also contributes a paper to this number (*BMB* 1198); and from 1944 to 1946 served as Major, RAMC, attached to the Australian Army. In 1946 he became Dean of the Medical School, Oxford University, and in October 1947 was appointed to the Chair of Chemical Pathology at Guy's Hospital Medical School, London. He is also Secretary of the Medical Research Council Conference on British Anti-Lewisite. Professor Thompson has worked with Professor Peters on pyruvate metabolism in vitamin-B<sub>1</sub> deficiency, and with Dr. R. J. Dubos on the nucleic acids of pneumococci. He has done much work on various applications of BAL, and on the action on cholinesterases of certain substances of interest in chemical warfare.

MR. M. V. TRACEY is a member of the biochemistry department of Rothamsted Experimental Station. He graduated from Cambridge University in 1940, where he had read biochemistry under Gowland Hopkins. After work on the manufacture and development of propellants for the Admiralty and on blood transfusion for the Ministry of Health he went to Rothamsted and worked on the proteases of green leaves. He is the author of a book on proteins at present in press.

MR. N. W. PIRIE studied under Hopkins in Cambridge; his first research there was on the chemistry and metabolism of sulphur compounds. Opportunities of collaboration with animal and plant pathologists in Cambridge led to research on antigens from *Brucella* and on plant viruses. This led to a general interest in large molecules of various types and to a tendency to doubt the usefulness of many of the concepts used in describing them. The biochemical department at Rothamsted, of which Pirie is head, is concerned with the isolation and characterization of the colloidal components of normal and virus-infected leaves. From this it is hoped that some understanding of the state of viruses in the cell and of their mode of multiplication will be gained.

PROFESSOR A. WORMALL is professor of biochemistry and chemistry in the University of London, at St. Bartholomew's Hospital Medical College. He graduated with honours in chemistry at Leeds in 1921, and was awarded his D.Sc. in 1930. He was demonstrator, and later lecturer, in biochemistry in the department of physiology at Leeds up to his appointment to the Chair at St. Bartholomew's in 1936. In 1928 he was awarded a Rockefeller Medical Fellowship by the Medical Research Council, and he spent a year with Landsteiner at the Rockefeller Institute studying some chemical problems of immunity. At the request of the Colonial Office he went to Uganda in 1930 to carry out investigations on human trypanosomiasis. These investigations were mainly concerned with the carbohydrate metabolism of sleeping-sickness patients, and with diagnostic tests for the disease; in particular, the red-cell adhesion test was suitably modified and found to be of definite practical value. Professor Wormall is specially interested in the chemistry of immunity, and in more recent years he has been using radioactive and stable isotopes for these studies. During the recent war, however, much of this work had to be put on one side in favour of more urgent mustard-gas problems. This mustard-gas work, started early in 1939, was later continued by a team under the leadership of

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## NOTES ON CONTRIBUTORS

Professor Wormall as an extramural war investigation for the Ministry of Supply. In much of this work radioactive sulphur was used, and radioactive isotopic tracers are now being used in his laboratory for the study of immunochemistry and some general problems of biochemistry.

DR. KENNETH BAILEY is an authority on proteins and is particularly concerned with structural proteins connected with the contractility of muscle. He graduated at Birmingham and after three years of research on carbohydrates took up the study of proteins at Imperial College and later at Cambridge. In 1939 he was awarded a Rockefeller Fellowship to study physico-chemical aspects of proteins under Dr. E. J. Cohn of the Harvard Medical School. At present he holds an Imperial Chemical Industries Research Fellowship. His early work in collaboration with Professor W. T. Astbury led to a general formulation of the mechanism of denaturation and was applied to the large-scale production of artificial wools. Later, he worked on the chemical and enzyme properties

of myosin and on the nature of fibrinogen-fibrin and has recently elucidated the myosin-actin interaction. In addition, he has isolated a new crystalline, fibrous protein, tropomyosin, from the muscle fibril, and has also taken part in the preparation of pure yeast pyrophosphatase and crystalline hexokinase. Publications include two reviews on muscle proteins (*Recent Advances in Protein Chemistry*, 1944, 1, 289; *Annu. Rep. Chem. Soc.*, 1946, 43, 280).

DR. R. A. KERWICK is director of the Division of Biophysics at the Lister Institute, London, and collaborates with the Medical Research Council Blood Products Unit, which is also housed at the Lister Institute, in the preparation of human plasma products. His interests have always been associated with the physico-chemical aspects of protein behaviour, with special reference to ultracentrifuge and electrophoresis measurements and their correlation with specific biological activity. His studies have ranged over pathological human sera, therapeutic anti-

toxic sera, and the design of bulk protein fractionation procedures. Papers have appeared in the *Biochemical Journal* and the *British Journal of Experimental Pathology*.

DR. A. NEUBERGER is a member of the Scientific Staff of the Medical Research Council at the National Institute for Medical Research. He is Secretary of the Protein Requirements Committee of the MRC and a member of the Committee of Protein Requirements of Infants; he is also a member of the editorial board of the *Biochemical Journal*. Dr. Neuberger was awarded the William Julius Mickle Fellowship of the University of London for 1946-47. His research up to the war was concerned mainly with the structural chemistry of proteins, dissociation constants of amino-acids and chemistry of amino-sugars. Since the war he has become interested in the metabolism of amino-acids and problems of protein nutrition. Various papers by Dr. Neuberger have been published in the *Biochemical Journal*, *Journal of the Chemical Society*, and *Proceedings of the Royal Society*.

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IN previous volumes the Bulletin contained, in addition to the scientific symposium which occupied the greater part of each number, subsidiary sections of bibliographical and historical interest. Starting with the first number of Volume 5, the Bulletin has been clearly divided into two parts. The collective monograph on a special subject which had become the characteristic feature of the Bulletin now constitutes Part I. Part II contains miscellaneous articles on medical subjects of scientific, bibliographical, and historical interest. The book-review section is extended and there are, as before, sections devoted to historical notes, film-reviews, and lists of contents of current British medical and cognate periodicals. It is our intention that Part II should be a medium for extending the range of interest of each number of the Bulletin and for enhancing its continuity as a periodical.

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## THE MEDICAL RESEARCH COUNCIL

### Its Origin, Constitution and Functions

F. H. K. GREEN M.D. F.R.C.P.

*Assistant Secretary, Medical Research Council*

The promotion of medical research on an organized scale has been accepted as a State responsibility in Great Britain for more than thirty-five years. The provision made by the State for this purpose is additional to the resources of universities and other independent foundations and institutions, but is itself substantial, amounting in terms of money expenditure in the current year to more than £770,000. These funds are administered by the Medical Research Council, a Government body though not, strictly speaking, a Government department. Like its sister organizations for industrial and agricultural research—the Department of Scientific and Industrial Research, and the Agricultural Research Council, respectively—the Medical Research Council is under the authority of a special Privy Council Committee of Ministers of the Crown. The Lord President of the Council—that is, of the Privy Council—is the Chairman of the Committee of the Privy Council for Medical Research and of the corresponding committees for scientific and industrial and agricultural research, and he is the Minister responsible to Parliament for the work of these three Government research bodies, an arrangement which assists effective co-operation between them.

#### Origin and Constitution

The Medical Research Council derives from the Medical Research Committee which was established in 1913 under the National Health Insurance Joint Commission to administer moneys provided for medical research under the National Health Insurance Act of 1911. This Committee had hardly had time to inaugurate its programme before it was confronted by the abnormal situation caused by the outbreak of the war of 1914-18. Co-operating closely with the Army Medical Service during that period, it promoted a large number of short-term studies relating to the treatment of wounds and injuries, to the etiology and treatment of tropical diseases, and to various other problems of military and civil hygiene, many of which have had permanent value. With the end of the war, and the passage of the Act of 1919 which established the Ministry of Health, there was a fundamental change in the administrative arrangements for the promotion of British government-aided medical research, one of the provisions of the new Act being to transfer this responsibility to a specially appointed Committee of the Privy Council. In 1920, accordingly, the former Medical Research Committee was reconstituted as the Medical Research Council under the statutory authority of the Committee of the Privy Council for Medical Research; it was granted a Royal Charter of

Incorporation and the funds for its work were thereafter provided directly from the Treasury in the form of a grant-in-aid approved yearly by Parliament, an arrangement which has persisted ever since. The Committee of the Privy Council for Medical Research consists, in addition to the Lord President as Chairman, of the Ministers in charge of the principal State departments concerned with questions of public health in Britain and the Empire overseas; the Minister of Health is Vice-Chairman, and the Secretary of the Medical Research Council for the time being is *ex officio* Secretary; this means, in effect, that there is direct contact between the Council and its Minister, the Lord President.

The Council itself consists nowadays of twelve members, three lay and nine scientific, with a Secretary and other administrative officers. The present Secretary is Sir Edward Mellanby, G.B.E., K.C.B., F.R.S., whose own researches on rickets and other health problems are well known. Members of the Council retire in turn at regular intervals, but the aim is to ensure that its scientific membership always comprises a body of distinguished experts with first-hand experience of research in clinical medicine and surgery, and in the more important of the fundamental sciences on which these are based, as well as in some of the specialities of medicine. The scientific members of the Council are appointed by the Privy Council Committee, after consultation with the President of the Royal Society (as representing independent scientific opinion in the country), and with the Council itself. Of the three lay members of the Council, one must be a member of the House of Lords and one a member of the House of Commons. The Council appoints its own Secretary, and its administrative and scientific staff.

#### Functions

While research into the nature and causes of disease, and into improved methods for its prevention, diagnosis and treatment, naturally forms an extremely important part of the research programme of the Medical Research Council, that programme is of very much wider scope. It deals also with the fundamental sciences of medicine—physiology, biochemistry, genetics and the like; with problems of nutrition and of the maintenance of general human well-being, mental as well as physical; and with the normal and abnormal physiological and psychological reactions of the human being to his work and environment. It may deal, in fact, with almost any question involving the "human factor".

To advise it on the promotion of research in particular branches of medical science, the Council has the help of a large number of expert technical committees which it has itself appointed from time to time. The terms of reference of these different committees cover a very wide range of subjects; some of them are appointed on a short-term basis, to direct research on a single problem or group of problems, and are discharged on the completion of that task; others, such as the Accessory Food Factors Committee and the Chemotherapy Committee, are standing committees which assist the Council in the organization of long-term inquiries over an extensive field. Committees set up between 1939 and 1945 to direct research on urgent war problems included the Military and Royal Naval Personnel Research Committees and the War Wounds Committee; others were the Malaria Committee, the Jaundice Committee, the Penicillin



Clinical Trials Committee, the Committee on Tuberculosis in Wartime, and there were many more. Two examples of special interest at present are the Committee on the Medical and Biological Applications of Nuclear Physics (the medical by-products of modern atomic research), and the Colonial Medical Research Committee, the latter appointed jointly by the Council and the Colonial Office to direct work on nutritional and other questions affecting the health and well-being of colonial peoples, including, of course, the study of tropical diseases. In promoting research on problems of industrial welfare and efficiency the Council has the advice of its Industrial Health Research Board, and of special committees on Occupational Medicine, Occupational Physiology, Occupational Psychology, etc.

The Council itself meets about nine times a year, to survey and plan its programme, to discuss questions of policy, to consider requests from Government departments and other bodies for assistance in dealing with health and other "human" problems within their sphere, to receive the recommendations of its various expert committees, to review and, where necessary, increase the appointments to its staff, and to deal with applications from independent workers for financial aid in their researches. To assist in planning and directing investigations undertaken at the request of the Ministry of Health or other Government departments, the Council has usually appointed *ad hoc* committees, including representatives of the departments concerned. One such body which is very active at present is the Committee on Industrial Pulmonary Disease, originally appointed in response to requests from the Home Office and the Mines Department, and reconstituted in 1945 by arrangement with the newer Ministry of Fuel and Power; this Committee has sponsored a long-term programme of research, now being widely extended, on the problem of occupational lung disease in coalminers and other industrial workers.

In addition to having full executive control of its Parliamentary grant-in-aid, the Council is empowered by its Charter to accept and administer charitable benefactions by gift or bequest for the support of medical research. Its constitution also enables it to collaborate freely with other official or non-official organizations, either in Britain or abroad, which have functions similar to its own. Examples of such non-official organizations in Britain are the Lister Institute of Preventive Medicine, the Imperial Cancer Research Fund, the British Empire Cancer Campaign, the Wellcome Foundation and the Nuffield Foundation. An overseas body which has given generous help and co-operation to the Council in many different ways is the Rockefeller Foundation of New York.

#### National Institute for Medical Research and Associated Establishments

The Council's administrative headquarters is at 38 Old Queen Street, London, S.W.1, and its central research laboratories comprise the National Institute for Medical Research, at present situated at Hampstead, London, with associated Farm Laboratories and a special building for nutritional research, at Mill Hill, a few miles away. The institute at Hampstead—a former hospital, which was acquired by the Medical Research Committee in 1914—has become inadequate for growing needs, and it is hoped

within the next two years to transfer its work to a new and much more commodious building on the Council's land at Mill Hill. The external structure of this new building was completed shortly before the war of 1939–45, and every effort is now being made to complete its internal equipment with minimum delay. Only laboratory research is done at the National Institute, the Council's programme of clinical investigations being carried out at other centres, as will be shown presently. Nevertheless, though much of the research work at the Institute is necessarily of a fundamental nature, a substantial part of it has an immediate bearing on clinical problems, and numerous field-studies in hospitals and elsewhere have been organized from the Institute; an instance is the new attack launched in 1946 on the etiology of the common cold; this is being carried out in a special unit at the Harvard Hospital, Salisbury, maintained jointly by the Council and the Ministry of Health. The research programme of the National Institute is a very wide one, divisible into the broad categories of physiology, pathology (including bacteriology, virus diseases and immunology), pharmacology, chemotherapy, biochemistry, endocrinology, and physics in relation to biological research. Diseases recently under intensive study there have included influenza, malaria and, during the war, the typhus fevers. A special responsibility of the Institute is the maintenance of standards of activity and purity for certain drugs, hormones, vitamin preparations and antitoxins, both in fulfilment of statutory obligations of the Council in the United Kingdom and, in many instances, on behalf of the World Health Organization (formerly the Health Organisation of the League of Nations). Sir Henry Dale, O.M., G.B.E., F.R.S., was the first Director of the National Institute; he was succeeded, on his retirement in 1942, by Dr. C. R. (now Sir Charles) Harington, F.R.S.

#### Clinical Research

Clearly, in any organized programme of medical research, prominence must be given to the study of problems of disease and injury as they are seen in patients—that is, to clinical investigations in hospital wards and outpatient departments. The Council has not established a special research hospital, deeming it preferable to take advantage of the available facilities and freer supply of clinical material at existing hospitals and the valuable opportunities to recruit and train new investigators which are provided by the day-to-day contact of research-workers with undergraduate and postgraduate students at academic centres. In conformity with this policy, the Council has for long maintained, wholly or in part, special units for clinical research at two London teaching-hospitals and at the National Hospital for Nervous Diseases, Queen Square, London. The oldest of these establishments is the Department for Clinical Research at University College Hospital, and it was here that the late Sir Thomas Lewis, F.R.S., carried out much of his famous work on diseases of the heart and blood-vessels. With the expansion of the Council's programme, the number of its special research groups dealing with clinical and other problems has been greatly increased in recent years; the Table appended shows the Council's chief existing research-establishments, other than the National Institute for Medical Research. The arrangement between the Council and the institution housing

**PRINCIPAL RESEARCH ESTABLISHMENTS OF THE MEDICAL RESEARCH COUNCIL OTHER THAN THE NATIONAL INSTITUTE FOR MEDICAL RESEARCH AND ASSOCIATED ESTABLISHMENTS (SPRING 1948)**

<i>Subject</i>	<i>Establishment</i>	<i>Place</i>	<i>Present Director of Unit or Department; or Head of Research Group</i>
General medicine	Department of Clinical Research	University College Hospital, London	E. E. Pochin, M.D., F.R.C.P. (salary provided by Rockefeller Foundation)
General medicine	Clinical Research Unit	Guy's Hospital, London	R. T. Grant, O.B.E., M.D., M.R.C.P., F.R.S.
Medicine (including nutritional and paediatric studies)	Department of Experimental Medicine	Cambridge University (with temporary field-research unit at Wuppertal, Germany)	Prof. R. A. McCance, Ph.D., M.D., F.R.C.P., F.R.S.
Diseases of the nervous system	Neurological Research Unit	National Hospital, Queen Square, London	E. A. Carmichael, C.B.E., M.B., F.R.C.P.
Problems of ear disease and deafness	Otological Research Unit	National Hospital, Queen Square, London	C. S. Hallpike, M.B., F.R.C.P., F.R.C.S.
Problems of vision	Vision Research Unit	Central London Ophthalmic Institute, Judd Street, W.C.1	H. Hartridge, M.D., F.R.S.
Treatment of cancer	Radiotherapeutic Research Unit	Hammersmith Hospital, London	Miss C. A. P. Wood, M.R.C.P., D.M.R.E. (half-time)
Industrial diseases and poisoning	Department for Research in Industrial Medicine	London Hospital	D. Hunter, M.D., F.R.C.P. (part-time)
Industrial health hazards, including injuries and skin diseases	Industrial Medicine Research Unit	Birmingham Accident Hospital and Rehabilitation Centre	J. R. Squire, M.B., M.R.C.P.
Burns	Burns Research Unit	Birmingham Accident Hospital and Rehabilitation Centre	" "
Industrial pulmonary disease	Pneumokoniosis Research Unit	Llandough Hospital and other centres, Cardiff	C. M. Fletcher, M.D., F.R.C.P.
Actions of drugs in man	Clinical Chemotherapeutic Research Unit	Glasgow University and Killearn Hospital	J. Reid, M.D., M.R.C.P. (part-time)
Clinical aspects of endocrinology	Clinical Endocrinology Research Unit	Edinburgh University and Royal Infirmary	(At present directed by a Committee)
Nutrition	Human Nutrition Research Unit	National Hospital, Queen Square, London, and London School of Hygiene and Tropical Medicine (with associated establishment in tropical Africa)	Prof. B. S. Platt, C.M.G., M.B., Ph.D.
Nutrition (vitamin studies)	Group for Research on Nutrition	Lister Institute of Preventive Medicine, London	S. S. Zilva, D.Sc.
Nutrition (vitamin studies)	Dunn Nutritional Laboratory	Cambridge University	L. J. Harris, Sc.D.
Dental disease	Dental Research Unit	King's College Hospital, London	J. D. King, Ph.D., L.D.S.

a particular establishment varies from case to case, but the Council usually provides the medical and other scientific workers and the research expenses, the institution supplying accommodation and, in the case of the clinical units, the cost of feeding and nursing the patients. A statistical-research unit has been part of the Council's organization since the earliest days of its work; the unit is housed in the Department of Medical Statistics at the London School of Hygiene and Tropical Medicine, the Director of the unit, Professor A. Bradford Hill, himself giving part-time service to the Council.

Apart from its research establishments in Great Britain,

the Council during the war despatched a number of field-research units overseas to carry out intensive investigations of health problems affecting the Fighting Forces. This principle is being extended in peacetime by the occasional appointment of special research groups to investigate health problems of importance to the Colonial Empire, at suitable centres abroad.

At the National Institute for Medical Research, at all the research centres listed in the Table, and at many others, the Council employs a whole-time scientific staff, appointed on either a permanent or a temporary basis. The large majority of the medical men or women directing, or working

<i>Subject</i>	<i>Establishment</i>	<i>Place</i>	<i>Present Director of Unit or Department; or Head of Research Group</i>
Bacterial chemistry	Bacterial Chemistry Research Unit	Lister Institute of Preventive Medicine, London	Sir Paul Fildes, O.B.E., M.B., F.R.S.
Bacterial chemistry	Group for Research in Chemical Microbiology	School of Biochemistry, Cambridge University	Miss M. Stephenson, Sc.D., F.R.S.
Cell metabolism	Cell Metabolism Research Unit	Sheffield University	Prof. H. A. Krebs, M.D., F.R.S. ( <i>part-time</i> )
Problems of blood grouping	Blood Group Research Unit	Lister Institute of Preventive Medicine, London	R. R. Race, M.R.C.S.
Preparation of blood derivatives	Blood Products Research Unit	Lister Institute of Preventive Medicine, London	A. N. Drury, C.B.E., M.D., F.R.S. ( <i>Hon. Director</i> )
Problems of transfusion	Blood Transfusion Research Unit	Postgraduate Medical School of London	P. L. Mollison, M.D., M.R.C.P.
Chemotherapy of malaria	Group for Research in Chemotherapy	Molteno Institute, Cambridge University	Miss A. Bishop, Sc.D.
Toxicology (with special reference to industry)	Toxicology Research Unit	Chemical Defence Experimental Station, Porton	J. M. Barnes, M.B.
Electromedical studies	Electromedical Research Unit	Ministry of Pensions Hospital, Stoke Mandeville, Bucks	R. B. Bourdillon, C.B.E., M.C., A.F.C., D.M.
Biophysics	Biophysics Research Unit	King's College, London	Prof. J. T. Randall, D.Sc., F.R.S. ( <i>Hon. Director</i> )
Medical problems of nuclear physics (including research on health hazards)	Radiobiological Research Unit	Atomic Energy Research Establishment, Harwell	J. F. Loutit, D.M., M.R.C.P.
Molecular structure of biological systems	Unit for Research on the Molecular Structure of Biological Systems	Cavendish Laboratory, Cambridge University	M. F. Perutz, Ph.D.
Industrial physiology	Groups for Research in Industrial Physiology	London School of Hygiene and Tropical Medicine	(i) T. Bedford, D.Sc. (ii) H. C. Weston, F.I.E.S.
Occupational psychology	Applied Psychology Research Unit	Cambridge University	Prof. Sir Frederic Bartlett, C.B.E., M.A., F.R.S. ( <i>Hon. Director</i> )
Occupational psychology	Group for Research in Industrial Psychology	Manchester and elsewhere	S. Wyatt, D.Sc.
Psychological and other "human" problems of the building industry (in relation to post-war reconstruction)	Group for Research on the Building Industry	Birkbeck College, London	Prof. C. A. Mace, M.A., D.Litt. ( <i>Hon. Director</i> )
Medical statistics	Statistical Research Unit	London School of Hygiene and Tropical Medicine	Prof. A. B. Hill, D.Sc. ( <i>part-time</i> )
Social medicine	Social Medicine Research Unit	Central Middlesex County Hospital	J. N. Morris, M.R.C.P., D.P.H., D.C.H.

in, these research establishments are whole-time servants of the Council who abstain from private practice. Among the subjects currently under study by members of the Council's staff at hospitals, university departments and other research centres outside the establishments listed in the Table are problems of disease in children, nutrition, clinical bacteriology, tuberculosis, chemotherapy, and the biological effects of radiation (with special reference to the treatment of cancer). Members of the Council's staff have pension-rights on retirement, which are provided through insurance policies to which both the Council and the member contribute.

#### Financial Aid to Independent Research Workers

While the greater part of the funds at the Council's disposal is devoted to the support of research by its own staff at the National Institute and elsewhere, an important fraction is, nevertheless, expended annually in the form of temporary grants made in aid of approved researches by entirely independent investigators at universities, hospitals and other institutions throughout the United Kingdom and, on occasion, overseas. These grants may be made variously for the personal support of the investigator on a whole-time or part-time basis, for the

provision of scientific or technical assistance to senior investigators, or for research expenses. Numerous investigations, at hospitals and elsewhere, by physicians or surgeons in practice are assisted by grants of one or more of these types. Where an application for a research grant comes within the field of interest of one of the Council's expert committees, the Council has the advice of the committee in considering it. An outstanding example of a research assisted by grants at a university centre during the war-years was the work by Sir Howard Florey and his colleagues at Oxford which led to the development of penicillin as a therapeutic agent. The grant system as a whole has produced a rich harvest of results of practical value.

Reference has been made above to the advantages, from the point of view of the recruitment and training of new research-workers in medical science, which are gained by the siting of most of the Council's clinical and other research establishments in academic centres. As a further aid to recruitment, the Council awards studentships for training in research methods to young graduates of special promise who are recommended for the purpose by the heads of the departments in which the training would be given. These studentships are tenable for a period of one year in the first instance, and are renewable up to a maximum of three years in all, subject to favourable reports from the supervisors of the work. One of the chief aims of the studentships is to make it possible for young men and women to contemplate, and display their fitness for, research careers who otherwise might be prevented by economic factors from doing so. Apart from these training studentships, which are tenable in the United Kingdom, the Council awards certain travelling fellowships to enable suitably qualified British workers to undertake periods of study and research at centres abroad. It has for long acted as the agent in Great Britain of the Rockefeller Foundation of New York, by awarding the travelling medical fellowships for British workers generously provided by that body, and it has its own series of travelling and research fellowships in tuberculosis, provided from the special benefaction in memory of Dorothy Temple Cross, of which it is the trustee.

### Reports and Publications

Before the war the Council had to submit annually to Parliament a Report on its work, which was published. The latest of these Reports to be issued was that for 1938-39. The series was interrupted by war conditions, but the continuity of the narrative has been resumed with a six-year Report, reviewing the Council's many activities during the war-period, which has just been published (Spring, 1948)<sup>1</sup>. All the Council's publications are printed and sold by His Majesty's Stationery Office. Best known among them is the series of green-covered Special Reports, on a diversity of medical subjects, of which more than 260 have been issued. Others deserving special mention here are the seventeen War Memoranda, giving up-to-date advice on practical problems (such as the medical uses of sulphonamides), which were issued by the Council between 1939 and 1946, and the series of reports dealing with problems of industrial hygiene and efficiency which have been produced under the authority of the Council's Industrial Health

Research Board. The Council's series of practical Memoranda is being continued in peacetime as a medium for the publication chiefly of summaries of existing knowledge, and the findings of *ad hoc* investigations. The results of the great majority of the researches supported by the Council are, however, reported directly by the investigators concerned, in papers contributed on their own initiative to medical and other scientific journals.

A *Bulletin of War Medicine*, consisting of abstracts and review-articles covering a large proportion of the contemporary medical and surgical literature from Allied and enemy countries, was produced by the Council from September 1940 till August 1946, with the help of the Bureau of Hygiene and Tropical Diseases.

### Other Activities

In addition to its primary task of promoting and supporting medical research, the Council during the war-period undertook a number of special executive functions on behalf of the Ministry of Health, with which it always maintains close co-operation. Thus it was in large measure responsible for organizing the Emergency Blood Transfusion Service for air-raid casualties in the greater London area, and it established four depots near London for the collection and storage of blood for transfusion, the staffs of which managed effectively to combine with their routine duties the making of substantial new contributions to knowledge of their subject. The Council also established units for serum drying and blood grouping at Cambridge during the war, the former of which, under the direction of Dr. R. I. N. Greaves, did interesting pioneer work on new methods of drying and preserving proteins, and the latter, under the late Dr. G. L. Taylor, successfully followed up and extended the American discovery of the Rh factor and its practical significance in blood transfusion and in paediatrics; the Blood Group Research Unit is being continued under the direction of Dr. R. R. Race at the Lister Institute, London (see Table). Moreover—and this, too, has proved a development of more than ephemeral significance—the Council in 1939 set up and administered, on behalf of the Ministry of Health, an Emergency Public Health Laboratory Service to augment the existing public-health services of the country in combating epidemics of infectious disease such as were likely to arise from the abnormal conditions of war, and to keep a constant watch for any suspected instance of "bacterial sabotage". While the Service did not, in the event, have any example of "bacterial sabotage" to contend with, it proved so notably successful in elucidating and restricting outbreaks of infectious disease and bacterial food-poisoning during the war that it is being extended in peacetime as the framework of an organization for carrying out nation-wide investigations of problems of public health and epidemiology. At the request of the Government, the Council accordingly agreed to administer the peacetime Public Health Laboratory Service on behalf of the Ministry for an initial period of five years. Statutory authority for the Service has been provided in the National Health Service Act of 1946.

Earlier in this article it was mentioned that one of the functions of the Council at its periodical meetings is to "survey and plan its programme". It should be emphasized, however, that long-term planning, save in very broad outline (as by the appointment of a committee or establish-

<sup>1</sup> *Medical research in war. Report of the Medical Research Council for the years 1939-45.* London: His Majesty's Stationery Office, 7s. 6d.

## BRITISH BIOCHEMISTRY

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In Britain, biochemistry was an early and vigorous outgrowth from modern physiology as it developed under the leadership of men like Sir Michael Foster. Foster (1924) was a firm believer in the importance of the study of the history of his subject; and in the first of his Lane Lectures on "The History of Physiology", delivered in San Francisco in 1900, he expressed that belief in the following words:

... What we know and what we think ... is a stream which flows by us and through us, fed by the far off rivulets of long ago. As what we think and say today will mingle with and shape the thoughts of men in the years to come, so in the opinions we are proud to hold today, we may, by looking back, trace the influence of the thoughts of those who have gone before ...

Our knowledge of history will reveal "... which of the thoughts of today are in the direct line of progress ...". This alone is sufficient reason for our application to a profound and detailed study of the history of British biochemistry.

A number of books on specialized biochemical subjects

provide us with specific examples of the power of the historical approach, but there has been nothing resembling a full account of the growth of the subject. Thus it is with hesitation that one attempts to sketch its history in a few pages. It is difficult to single out the contribution of one nation from the essentially international progress of science. However, even the most superficial consideration reveals that, in the biochemical field, Great Britain has contributed generously in terms of ideas, technical methods and hard work, the three essential components of creative scientific activity.

### *One Hundred Years Ago*

In July 1947, the Chemical Society celebrated its centenary. A hundred years ago biochemistry in Britain was in its embryonic stage. At home, formative influences, such as the work of Thomas Graham, first President of the Chemical Society, were developing. Abroad, Liebig in Germany, and Pasteur and Claude Bernard in France, were leading the world in establishing the basic principles of the subject. Development in Britain was comparatively slow up to 1900, and British biochemistry must be said to be essentially a twentieth-century phenomenon.

The chemical activities of living creatures have excited the interest of the natural philosopher from the earliest days, and led him to many significant observations. In 1772 Joseph Priestley showed that green leaves produce oxygen, the first important observation in connexion with photosynthesis. In 1810 Wollaston discovered the sulphur-containing amino-acid cystine, so-called because he found it in urinary calculi. However important, these discoveries did not constitute part of a connected scientific discipline. The present vigorous growth of the subject had its serious, organized beginnings in the period towards the end of the nineteenth century when the rationalization of medicine was taking place. This movement brought human physiology to maturity as an independent science, after it had

## MEDICAL RESEARCH COUNCIL

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ment to carry out research over a considerable field), is rarely possible in medical science; the discovery of a preventive or cure for a particular disease is nearly always opportunist, depending upon the unpredictable occurrence of new clues for investigation, and upon the availability of research workers with the right type of knowledge and imagination to follow them up. Similar opportunist factors largely determine the range of the Council's research programme at any given time, and the number and staffing of its research establishments, though these are occasionally set up on an *ad hoc* basis to examine a particular health-hazard calling urgently for attention. Fleming's original work on penicillin was a good example of an opportunist investigation, arising in the course of studies of quite a different kind; on the other hand, the American discovery of streptomycin resulted from a "planned" attempt to find an antibiotic which would be therapeutically effective against the penicillin-resistant gram-negative microbes, though its still more remarkable action in certain forms of tuberculosis must have come as an agreeable surprise to its discoverers. Sometimes a long-term programme of "academic" research in physiology or biochemistry may itself lead suddenly to a discovery of immediate clinical value; while, as has been seen recently, the practical application of fundamental discoveries in the physical sciences may provide

new and totally unexpected vistas of exciting exploration in biology and medicine. Thus, the finding that radioactive isotopes of the elements can be produced artificially and, while behaving chemically exactly like the stable elements, may be readily traceable in the living body by virtue of their radioactivity, has supplied a method of fascinating promise for investigating the detailed chemistry and physiology of vital processes, as also has the use of naturally-occurring, non-radioactive isotopes as "tracers" by means of mass-spectrography. With these new research weapons of unforeseeable range, with the record of practical achievement during the last decade, and with the recent advances in chemotherapy, in bacterial chemistry and the study of microbic antagonism to provide embarkation points for further voyages of discovery, the prospects for medical research are brighter now than at any previous time. It is to be hoped that the free co-operation and exchange of scientific information established between medical scientists of the Allied nations during the war may be extended on an international scale for the still more rapid advancement of knowledge aimed at increasing human health and well-being in the years to come. It will be a task of the Medical Research Council to assist such co-operation to the fullest extent possible and to ensure that, so far as Great Britain and the Colonial Empire are concerned, the opportunities of the coming years are used to good effect.



functioned for a long period as a minor appendage of Anatomy. Biochemistry began then as a lesser aspect of physiology, but developed rapidly to play its present leading role.

The preponderant influence of medicine has remained a feature of biochemistry in this country. Although agriculture provides a vastly richer source of fascinating problems, it has had a much smaller influence. It may be significant that the decline of British agriculture had already set in before biochemistry had begun its vigorous development.

The advance of biochemistry depended primarily upon the enormous edifice of organic chemistry built mainly by the Germans during the last century. It is a disadvantage, perhaps still felt, that we in this country were late in recognizing this fact. As late as 1913, the late Sir Frederick Gowland Hopkins, in his presidential address to the Physiological Section of the British Association, found it necessary to reiterate the appeal made by Justus Liebig to the Chemical Section of the same organization in 1837, pleading for the closer integration of organic chemistry and biology. Today we are able to look back on many achievements based on that lesson. However, this alone would not have given us modern biochemistry, which, rightly, is concerned not mainly with the analysis and synthesis of substances of biological importance, but with the manner in which living organisms achieve chemical changes.

This brings us into the field of colloid chemistry and catalysis. About the middle of the last century, Thomas Graham characterized the colloidal state, and his colleague, Sidney Ringer, investigated the balanced activities of inorganic constituents in regulating energy discharges in living cells. Ringer made his observations long before Arrhenius put forward his Ionic Theory. It is an interesting sidelight on the narrow outlook of many scientists of the time that Arrhenius was unaware of how Ringer's observations bore eloquent testimony to the correctness of the ionic concept.

Physical chemistry provided one of the most delicate and successful tools used in biochemistry. Thudichum, Archibald Garrod, MacMunn and F. G. Hopkins, of the developing school of British biochemists, all used it to make observations of the first importance, before the end of the nineteenth century. Among the many brilliant observations of the ill-fated MacMunn (1886) was the discovery in 1886 of "myohaematin" or "histohaematin"—the substance now better known as cytochrome. This observation did not attract the attention it deserved because of the attacks of the famous continental biochemist Hoppe-Seyler, who did not accept it. MacMunn was so discouraged that he gave up his researches. Hopkins used the spectroscope in his classical work on the pterine pigments in butterfly wings.

Archibald Garrod was one of the first to achieve that revolution in thought by which metabolism came to be considered in terms of enzyme-catalyzed paths rather than as a gross process of combustion. He was the father of biochemical genetics, and it is only now that his views are producing a rich harvest in the work of the American school led by G. W. Beadle and E. L. Tatum. It is to the credit of a number of British workers that they carried this line of development forward during the long interim period. Prominent among them were V. A. Onslow, Mrs. Onslow,

J. B. S. Haldane and R. Scott-Moncrieff, all of whom worked in Hopkins' laboratory.

It is not possible to pass to the twentieth century without mentioning Thudichum, a prominent contemporary of Garrod's. Thudichum gave us the first firm chemical data on a number of the constituents of nervous tissues: he founded the chemistry of the brain.

#### *Hopkins, Harden and their Collaborators*

Gowland Hopkins dominated the development of biochemistry for the next forty years. By 1900 he had contributed his elegant work on the pterine pigments. In 1898 he and Pinkus had developed a greatly improved method for the crystallization of egg-albumin. In 1901 he and S. W. Cole isolated the amino-acid tryptophan from a tryptic digest of casein. Thus within two years he participated in two major contributions to protein chemistry. Then followed his nutritional studies, which established the nutritional importance of tryptophan and led to his discovery of the accessory food substances—the vitamins.

Hopkins inspired many lines of work now actively pursued all over the world. In some of them he conducted the classical experiments himself. The modern concept of the metabolic process directly concerned with energy production by working muscle, dates back to the work of Walter Fletcher & Hopkins in 1907. They confirmed previous observations that, when a muscle is made to contract in the absence of oxygen, lactic acid is produced. They also showed that the lactic acid is removed and glycogen reappears when the muscle is allowed to resume oxidative metabolism. This provided the essential idea of the muscle-cycle and of other glycolytic systems.

At about the same time Harden and his collaborators at the Lister Institute in London were working on the chemistry of the fermentation processes. This work was to merge eventually with the developments of Hopkins and Fletcher and in particular with the contributions of the German-led school in Europe, in the great burst of advances in our knowledge of the processes of glycolysis, which took place after the first World War.

In 1897 Buchner, in Germany, had shown that an extract of crushed yeast, from which all intact cells had been removed, retained the capacity to ferment sugars. Harden and Young studied this cell-free fermentation process and showed that the extract converted certain sugars to fructose diphosphate. This discovery ranks with the greatest in the history of the subject. Besides showing the importance of the phosphate esters in metabolism, Harden & Young (1904) were the first to demonstrate the existence of a co-enzyme: a heat-stable, dialyzable substance needed to activate an enzymic system. In 1904 they showed that such a substance, which they called co-zymase, now known as co-enzyme I, was essential in the yeast fermentation process.

Later, Robison, a pupil of Harden, discovered hexose monophosphate. Also, through a chance observation, he was able to show that the phosphate esters are concerned in the formation of calcium phosphate in calcifying tissues. In 1927, Eggleton and Eggleton, working at University College, London, showed that a new form of organic phosphate was involved in glycolysis. This was named phosphagen. It proved to be the substance, phospho-creatine, which had been isolated from muscle by the Americans Fiske and Subbarow in the same year.

These advances, combined with new knowledge of cellular oxidation-processes, marked the opening stages of the tremendous development in the study of cellular metabolism which took place between the two wars. In Britain, a large part of the work was concentrated in Hopkins' laboratory. Later it grew up in other centres mainly under the guidance of his former pupils, R. A. Peters at Oxford and H. A. Krebs in Sheffield.

The realization of the importance of carriers in biological oxidation processes began in 1921 with Hopkins' isolation of glutathione. This was followed in 1925 by Keilin's confirmation of MacMunn's discovery of cytochrome and his demonstration of its components and their role in cellular oxidation. M. Dixon, D. E. Green, Keilin again and many other workers in the Cambridge school contributed a mass of information on the nature of oxidation paths in the cell.

### *Bacterial Chemistry*

In the same school J. and D. M. Needham were studying the glycolytic systems in mammalian striped muscle and other tissues. J. H. Quastel and Marjory Stephenson were laying the foundations of the study of bacterial metabolism, using washed suspensions of bacteria. Since that time Quastel's interests have extended to a diversity of fields. The traditional study has been carried on by Stephenson and her school with a regular series of important discoveries. Stephenson's studies have been confined to dynamic aspects of the subject. The other famous group of bacterial chemists in this country, built up by Sir Paul Fildes and B. C. J. G. Knight at the Middlesex Hospital in London, devoted its attention to the nutritional requirement of bacteria and added a great deal to our understanding of vitamins and the nature of parasitism. The high-light of the work of this school was Woods' (1940) observations on the nature of the antibacterial action of the sulphonamides.

R. A. Peters, who has held the chair of biochemistry at Oxford for many years, has contributed much to the science, both as a philosopher and as a practical man. He was one of the first to link a vitamin with a metabolic process (Peters & Thompson, 1934) by showing that vitamin B<sub>1</sub> has a co-enzymic effect in the oxidation of pyruvate in brain. A recent outstanding achievement of his school was the production of BAL (British Anti-Lewisite).<sup>1</sup>

H. A. Krebs is the author of a great deal of important work on cell-metabolism. He is probably best known for his work on mammalian urea-production via the so-called ornithine cycle, or Krebs urea cycle (Krebs & Henseleit, 1932), and for his work (Krebs & Johnson, 1937) demonstrating the function of tricarboxylic acids in cell-metabolism.

Like Krebs, J. H. Quastel has produced a large volume of work on cell-metabolism. One of his most fruitful contributions was his demonstration (Quastel & Wooldridge, 1928) that malonate inhibited the oxidation of succinate by the enzyme succinic dehydrogenase. The degree of inhibition depended on the relative concentrations of the substrate (succinate) and the inhibitor (malonate). This phenomenon was called competitive inhibition. The principle was invoked by Woods to explain the competition

between *p*-aminobenzoic acid and sulphanilamide in their effect upon the growth of bacteria. Sulphanilamide prevents growth, but if *p*-aminobenzoic acid is present the amount of growth increases roughly in proportion to its concentration. Competitive inhibition has become one of the principal concepts of modern chemotherapeutic theory.

### *Biological Organic Chemistry*

The advances which have been described show the very great importance of organic chemistry in the development of biochemistry. However, there is a great tradition of biological organic chemistry in this country which has developed on rather different lines from those already described. The difference between the two traditions is one of emphasis, and each has contributed to the growth of the other.

One of the achievements of organic chemistry arising out of the work of Hopkins was C. R. Harington's synthesis of glutathione (Harington & Mead, 1935). Harington is an outstanding representative of the school of biochemistry built by George Barger. Barger studied chemical aspects of pharmacology, chemotherapy, hormones and vitamins. Harington and he were responsible for the classical work on the hormone thyroxine. In 1926 Harington (1926a) was successful in isolating it from thyroid glands. Shortly afterwards he established its chemical structure (1926b). The work was brought to a triumphant conclusion by the synthesis of thyroxine (Harington & Barger, 1927).

During the course of this century Barger achieved many syntheses and characterized numerous biologically-important substances. His greatest interest was in the so-called simpler natural bases. In 1905 he and Jowett came near to the synthesis of adrenaline. This synthesis was achieved by H. D. Dakin and simultaneously by continental workers. Barger collaborated with Sir Henry Dale in much work on the sympathomimetic amines. They isolated histamine from the animal gut and synthesized tyramine. Barger also synthesized methionine and carnosine and was associated with A. R. Todd and others in their work on the synthesis of vitamin B<sub>1</sub>. Barger was trained as a botanist as well as an organic chemist and in the course of his life made contributions to the chemistry of the alkaloids and glycosides.

Dale's most striking biochemical work was done in collaboration with H. W. Dudley (1927). These two workers were the first to isolate acetylcholine. Dudley was a brilliant worker who will be remembered for contributions such as the discovery of the enzyme glyoxalase (Dakin & Dudley, 1913), which converts methyl glyoxal to lactic acid.

In the last twenty years cyclopentenophenanthrene derivatives have been shown to have a variety of important biological functions as sex hormones, heart drugs, carcinogenic agents, bile acids, etc. British workers have played an essential part in this development. In 1932 Rosenheim & King put forward the idea that the sterols and bile acids were cyclopentenophenanthrene derivatives. This had a revolutionary effect and led to the rapid solution of the structure of many representatives of the above types of compounds. Prominent among the workers in this field were the British chemists Cohen, Cook, Dodds, Hewett and Kon.

<sup>1</sup> [See also *BMB* 1198.—Ed.]

A little earlier Marrian (1930), working at University College, London, had isolated the important female sex hormone, oestriol, from pregnancy urine. This was his first outstanding success among his important studies of the chemistry of the sex hormones.

For many years J. W. Cook, Kennaway and their collaborators searched among the coal-tar products for those responsible for its carcinogenic effects. They isolated and identified many polycyclic hydrocarbons with carcinogenic properties. Others they synthesized. Cook and E. C. Dodds initiated the study of synthetic oestrogenic substances. They were able to show that the oestrogenic effect could be obtained with a wide variety of chemical substances. The same group of workers established the important connexion between the oestrogenic and carcinogenic effects.

The University of St. Andrews is famed for its school of sugar chemistry which grew up at the end of the last century under the leadership of Purdie and Irvine. Purdie developed a gentle method for the methylation of the hydroxyl groups of sugars, whereby it became possible to carry the study of sugar chemistry forward after it had reached an impasse. Purdie's method opened the way for the study of the ring-structure of the monosaccharides and the way in which they are joined together to form higher sugars. The leader of British sugar-chemistry today is Sir Norman Haworth. He was formerly at St. Andrews and now heads the chemistry school at Birmingham. In 1925 he demonstrated the pyranose ring structure in sugars. A number of his collaborators, led by E. L. Hirst (*Ault et al.* 1933), achieved the first successful synthesis of vitamin C.

Britain has contributed relatively little chemical work in the field of vitamins. Besides the synthesis of vitamin C, contributions have been made to the chemistry of vitamin D and vitamin B<sub>1</sub>. Rosenheim & Webster produced vitamin-D activity by irradiating phytosterols in 1925; in 1932 a team of workers, *Askew et al.*, were successful in isolating pure crystalline vitamin D<sub>2</sub> from irradiated ergosterol. The contributions of Todd, Bergel and their group to the synthesis of vitamin B<sub>1</sub> have already been mentioned.

Todd was a pupil of Sir Robert Robinson, the leading British organic chemist. Robinson is best known for his work on two widespread groups of organic compounds occurring in the plant kingdom, the alkaloids and the anthocyanins and flavones. He achieved his classical tropinone synthesis in 1917; in 1924 Pratt & Robinson synthesized the anthocyanidin pelargonidin; ten years later Robinson (1934) announced his method for the synthesis of the complete anthocyanin molecule.

#### *Plant-Biochemistry*

Although many able organic chemists in Britain have devoted themselves to the study of plant products, the British tradition in plant-biochemistry is not strong. The work of Raistrick and his colleagues on the constitution of many substances which are produced by the metabolic action of moulds upon simple sugars is a major contribution

to our understanding of plant metabolism. Schryver's small school at South Kensington did much work in the field of analysis and isolation of plant products. Schryver was succeeded by A. C. Chibnall, who has an international reputation for work in this field, in particular for his classical work on the chemical constitution of the plant- and insect-waxes and his contributions to our knowledge of the amino-acid composition of proteins.

Two important recent advances in plant-biochemistry have been due to British workers. In 1940 C. S. Hanes reported the biosynthesis of one component of starch, and in the same year R. Hill demonstrated the production of oxygen by isolated chloroplasts.

#### *Recent Developments*

R. Hill (1939) has had a long association with biochemistry in Britain. His early work on haemoglobin formed part of the impressive series of studies on the respiratory function of the blood which started in Cambridge before the first World War. Many famous names are associated with that work: Barcroft, Haldane, Keilin, Roughton and others.

It has not been possible to consider all the important biochemical developments which have taken place in Great Britain. No mention has been made of the influence of men like Sir William Bate Hardy, Benjamin Moore and Raphael Meldola. Hardy contributed most to the field of biophysics, which has not been given its due attention in this survey. Physico-chemical methods have been greatly developed by British workers during the last two decades. Very recently Martin & Synge (1941) developed the partition-chromatogram and immediately effected a revolution in the amino-acid analysis of proteins. They were able to make great advances towards the solution of the problem of the quantitative separation of the mono-amino-acids, which had baffled the organic chemist for decades. Astbury, Bernal, Crowfoot and others developed x-ray analysis and applied it to the elucidation of the structure of biological molecules such as the fibrous and crystalline proteins. Bernal settled the doubt as to the detailed structure of cholesterol by this means. Confirmation of his view came from the field of surface chemistry, which had been developed in this country by E. K. Rideal and N. K. Adam.

Recent achievements such as the production of British anti-lewisite and penicillin represent the highest fruit of the British tradition. Each of them is a more than full justification for the many lines of earlier work upon which they depended: microbiology, enzyme studies, organic chemistry and many others. With a very limited scientific personnel, Britain is now faced with the difficult task of deciding which of the many profitable fields of biochemical study open to us will be the most profitable. It is not the task of the writer to propose a solution here. It is sufficient to say that whatever the general lines of the future development in British biochemistry, we can confidently expect it to continue to produce some of the world's best and most original contributions.

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## CHEMOTHERAPY: A JOINT CHAPTER IN THE HISTORY OF CHEMISTRY AND MEDICINE

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*Chemistry is an Art, whereby sensible bodies contain'd in vessels, (or at least capable of being contained therein and render'd sensible;) are so chang'd, by means of certain instruments, and especially fire, that their several powers, and virtues are thereby discover'd; with a view to the uses of medicine, natural philosophy, and other arts and occasions of life.*

H. Boerhaave

*A new method of chemistry*, translated by P. Shaw & E. Chambers, London, 1727, p. 51

The relationship between chemistry and medicine, so intimate at the present time, extends backwards through the centuries to the distant times when primitive man, in his efforts to mitigate the hardships of life, came to associate in his mind, in his folk-lore, and in his writings, the ingestion of certain crude vegetable drugs—mineral drugs came later—with the alleviation of some of his bodily ailments. The Ebers papyrus, which dates from about the 14th century B.C., is actually a text-book of materia medica and is believed to contain a reference to colchicine (Sharp, 1909), whose biological effects are still the subject of intensive study. The name of Galen (131–201 A.D.) is familiar to students

of the history both of medicine and of chemistry, and is preserved to us to this day in the term "galenical". Such was Galen's influence that his teachings held sway for over a thousand years, until the iconoclastic figure of Paracelsus (1493–1541) came upon the scene, introducing the "iatro-chemical" period, to be followed closely by Vesalius (1514–1564), the father of anatomy, and by Harvey (1578–1657), the father of physiology. To these three men we owe the foundations of modern medicine, which has advanced with ever-increasing vigour since their time, particularly during the past 100 years with the growth of our precise and intimate knowledge of chemistry and pharmacology, and the rise of microbiology. As a sign of the times, the oldest national chemical society in the world was founded in London in 1841 under the chairmanship of Thomas Graham, the father of colloid science, and recently celebrated the centenary of its foundation, the observance of the occasion having been postponed because of the war. In 1858 Kekulé and Couper crowned the work of Dalton and Frankland with the structural theory of organic chemistry and paved the way for synthetic organic chemistry in the modern sense. Pharmacology, too, was put upon a sure foundation about the same time by Buchheim who emphasized that "die Arzneimittellehre ist eine theoretische, d.h. erklärende Wissenschaft und hat die Aufgabe, uns die auf die Arzneimittel bezüglichen Kenntnisse darzubieten, durch welche die Richtigkeit unseres Urteils über ihre Brauchbarkeit am Krankenbett gefördert werden kann" (Schmiedeberg, 1912). Following upon these events are recorded the foundation of bacteriology by Pasteur and Koch, its systematization by Cohn, Lord Lister's zealous advocacy of antiseptics, and the study of toxins and anti-toxins (Roux; von Behring), which was placed on a precise quantitative basis by Ehrlich. The great advances in microscopy in the early part of the century made by Lord Lister's father, Joseph Jackson Lister, and later by Abbe, coupled with selective staining (Weigert; Ehrlich) and other improvements in microbiological methods, led to the discovery, towards the end of the century, of protozoal parasites as the causes of disease, the names of Manson, Laveran and Bruce coming readily to mind in that connexion. The position at the turn of the century was therefore that chemistry, pharmacology, microbiology and parasitology had severally made distinguished progress during the nineteenth century but no one science had markedly made its influence felt upon any of the others. It was therefore

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a timely development when Ehrlich brought about a fusion and founded experimental chemotherapy, which embraced them all. Although he took a medical qualification Ehrlich did not take his ideas from medicine, supporting them with chemical knowledge, but conversely, to quote his own words (1909), "ich während meiner ganzen wissenschaftlichen Arbeit mich bemüht habe, das, was uns die Chemie lehrt hat, auch der Medizin nutzbar zu machen". In searching for substances which should be lethal to infecting parasites and yet harmless to the infected host, Ehrlich sought to apply what a life-time's study of the selective affinities of chemicals for cells had taught him.

### Chemotherapy of Protozoal and Spirochaetal Infections

#### Early Trypanocidal Dyes : Bayer 205

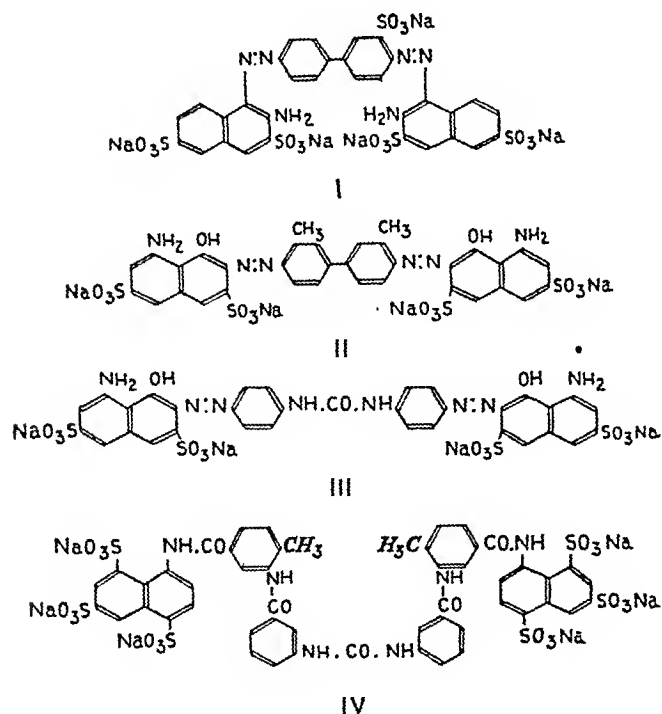
The successful development of chemotherapy as an experimental science depended upon the transmission of diseases to experimental animals and Laveran & Mesnil's demonstration (1902a) that trypanosome infections could thus be studied in mice provided Ehrlich with a convenient subject for study. With Shiga, Ehrlich (1904) showed that the dye trypan-red (I) had the effect which he sought but a more successful substance was found by Mesnil & Nicolle (1906) to be trypan-blue (II), which found practical application in piroplasmosis of domestic animals (Nuttall & Hadwen, 1909). A further substance studied by Mesnil and Nicolle was trypan- (or afridol-) violet (III) which, although not applied practically, is of great historic interest as being the first representative of the symmetrical urea type of drug, further developed in 1912 by Heymann (see Roehl, 1926a), who replaced the chromophoric azo-linkage by amide groups, thereby abolishing undesirable tinctorial properties and ultimately yielding Bayer 205 (germanin, suramin, Fourneau 309) (IV), one of the most remarkable, and probably the most complex, of drugs ever

synthesized. The lineal descent of Bayer 205 from trypan-blue is reflected biologically in the fact that trypanosomes which have acquired resistance to trypan-blue are also resistant to Bayer 205 (Leupold, 1924), acquired resistance to one compound being usually accompanied by resistance to chemically-allied substances only. Bayer 205, or suramin, to give it its non-proprietary pharmacopoeial name, is one of our most valuable drugs in the chemotherapy of sleeping sickness, being useful prophylactically and also for the treatment of established infections provided the central nervous system is not involved.

#### Arsenicals

Although inorganic arsenic had been used empirically for trypanosomiasis in domestic animals for some time (Braid, 1858; Livingstone, 1858) the results can be described, at best, as indifferent (Laveran & Mesnil, 1902b) and a marked advance was Thomas's demonstration (1905) in Liverpool that atoxyl was an effective agent in trypanosomiasis. Stimulated by this observation, Ehrlich & Bertheim (1907) proceeded to the elucidation of the correct constitution of atoxyl (V) and then to the development of salvarsan, which Ehrlich & Hata (1910) introduced for the treatment of syphilis, the causative agent having just previously been demonstrated by the zoologist Schaudinn. Shortly afterwards, neosalvarsan, or neoarsphenamine (VI), was introduced and, with one or two analogous derivatives of the same parent compound, constituted chemotherapy's greatest accomplishment for many years.

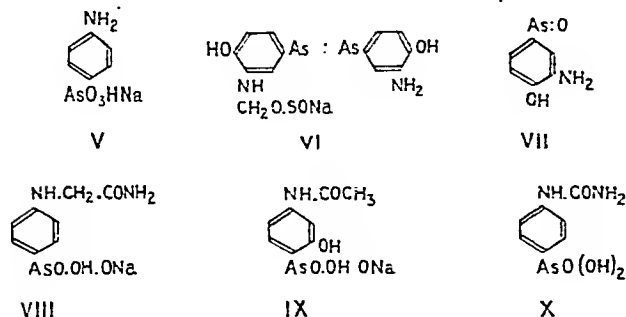
It was found that while atoxyl was active *in vivo* it was not active *in vitro* against trypanosomes and it was concluded that reduction in the body to the trivalent arsenoxide stage preceded trypanocidal action and, similarly, as there is a latent period of several hours before spirochaetes, or trypanosomes, are cleared from the blood of animals treated with the arsphenamines, it was again concluded that conversion to the arsenoxide precedes chemotherapeutic action (Voegtlin & Smith, 1920). Although the arsenoxide is considered to be the form in which the arsphenamines exert their spirochaeticidal action in the body, Ehrlich and Hata had rejected this substance (VII) as being too toxic for clinical use, but work in the last decade has clearly shown that it has as satisfactory a chemotherapeutic index as the arsphenamines. There is good evidence to show that the arsenoxide interferes with the turnover of sulphhydryl groups in the parasite and by this interference a vital metabolic reaction is stopped. Conversely, by competition with the thiol groups of the parasite, the addition of glutathione and certain other thiol compounds both *in vitro* and *in vivo* protected trypanosomes against the arsenoxide by combining reversibly with the latter. An elegant application of this affinity of thiol groups for arsenic is to be found in BAL (British Anti-Lewisite), 2:3-dimercaptopropanol<sup>1</sup>, in which it was argued that, by forming a ring with two adjacent thiol groups, a less readily reversed detoxication of the arsenic could be achieved (Stocken & Thompson, 1946). So far, therefore, out of the hundreds that have been studied, those arsenicals which have attained a place in clinical medicine are: the arsphenamines and mapharside (VII), which are used in syphilis; tryparsamide (VIII) and orsanine (IX),



<sup>1</sup> [See *BMB* 1198 in this number.—Ed.]

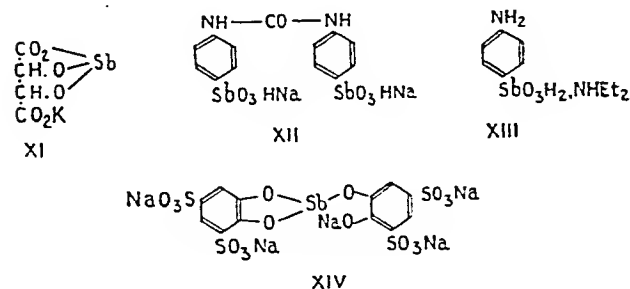


which are used in trypanosomiasis on account of the ease with which these drugs can penetrate into the central nervous system and so reach parasites inaccessible to Bayer 205; and carbarsone (X), which has received some application in amoebic dysentery along with the alkaloid emetine and the iodohydroxyquinolines.



### Antimonials

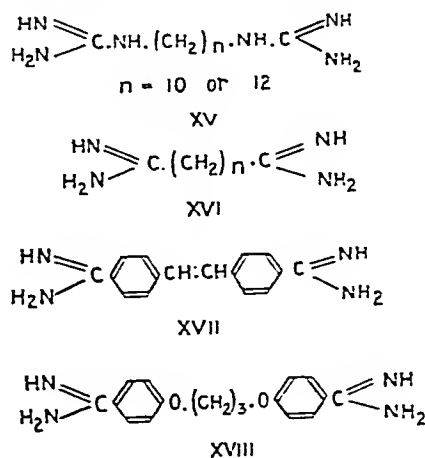
The use of antimony, the congener of arsenic in the Periodic System of the elements, has not developed to the same extent as that of the latter, due, in some measure, to intrinsic chemical disadvantages. Although Plimmer & Thomson (1908) found at the Lister Institute that rats infected with trypanosomes could be freed from parasites by tartar emetic (XI) and its sodium analogue, the most significant application of antimony in chemotherapy has been in kala-azar. In 1912, Vianna found that cutaneous leishmaniasis could be influenced by tartar emetic, and the introduction by Rogers (1915) of tartar emetic in India for the treatment of kala-azar replaced symptomatic treatment, which was practically invariably unsuccessful, by specific therapy. Since 1915, a number of pentavalent antimony compounds have received careful clinical trial in kala-azar, and Brahmachari's urea-stibamine, of which the main component is the symmetrical urea (XII) (Gray, Trevan, Bainbridge & Attwood, 1931), and neostibosan (XIII) have come into fairly wide use for the treatment of infections in India and China. On the other hand, mediterranean infections respond better to tartar emetic and fouadin (XIV). Many compounds of antimony with hydroxy acids have been tested for chemotherapeutic activity but, of these, only two, sodium antimony tartrate and its potassium analogue (tartar emetic), are used in medicine at the present time. Similarly, trivalent antimony compounds with phenols and mercaptans are well known. Of the former, fouadin (stibophen) came into extensive use in 1929 (Khalil



*et al.*) and partly displaced tartar emetic in the treatment of schistosomiasis, the latter having come into prominence for this purpose in 1918 (Christopherson). Still later, in 1936, anthiomaline was introduced by french workers but current opinion is divided as to the value of this drug.

### Diamidines

In considering the mode of action of Bayer 205, von Jancso & von Jancso (1934) considered that the drug interfered with the sugar metabolism of trypanosomes. It was known that hypoglycaemia occurs in experimental trypanosome infections, and that trypanosomes, furthermore, consume large amounts of glucose. The von Jancsos (1935; also Schern & Artagaveytia-Allende, 1936) therefore proceeded to an examination for trypanocidal activity in vivo of the synthalins—discarded several years previously after a brief but inglorious career as an oral substitute for insulin—and did indeed observe activity, but not because of any effect on sugar metabolism, since Lourie & Yorke (1937) showed synthalin to act directly on trypanosomes in vitro in high dilution. With the chemical collaboration of King (King, Lourie & Yorke, 1937), it was found that the guanidine groups of synthalin (XV) could be replaced by other groups, and, in particular, by amidine groups giving diamidines (XVI), which were yet more active and less toxic than the diguanidines. Later, it was found that the alkylene chain could be replaced by aromatic groups (King, Lourie & Yorke, 1938) and further development of this type in the May and Baker laboratories has led to stilbamidine (XVII), propamidine (XVIII) and pentamidine (Ashley *et al.* 1942). Like Bayer 205, these compounds are markedly active in the early stages of *T. gambiense* and *T. rhodesiense* sleeping sickness but their most fruitful application has been in kala-azar, in which antimony-resistant cases have responded, and in babesiasis in domestic animals (Yorke, 1944). Propamidine has also received some application as a topical antibacterial agent but marked toxicity is a disadvantage shared by these compounds.

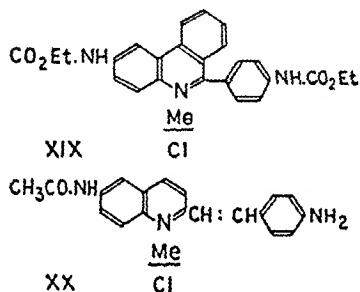


### Phenanthridinium Compounds

In 1931, Morgan & Walls at Teddington began a comprehensive investigation of phenanthridine compounds based on the readily available 2-aminodiphenyl. Biological tests from time to time failed to reveal promising

activity until Browning and his collaborators encountered trypanocidal activity in quaternary salts from 3 (and 7) -amino-9-*p*-aminophenylphenanthridine derivatives (Morgan *et al.* 1938). Further investigation of this series has revealed substances with pronounced activity against the relatively resistant *T. congolense* infections (Walls, Browning, Calver & Leckie, 1945), and recently activity against *T. cruzi* has been detected (Walls *et al.* 1946), only one other drug (Bayer 7602 Ac) being notably active against the latter parasite, which is refractory to other classes of trypanocidal drugs.

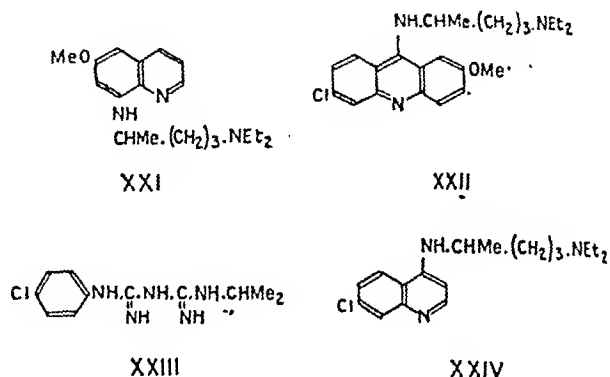
It is of interest to note that the phenanthridinium compounds bear a distinct resemblance chemically to trypanocidal styrylquinolines, which were previously studied by Browning and Cohen with their collaborators (Browning, Cohen, Ellingworth & Gulbransen, 1926, 1929), as shown by the following formulae (XIX, XX) of highly active compounds in the respective series, the elimination of the -CH:CH- group being one which the chemist can envisage with equanimity:—



#### Antimalarials

The time-honoured use of quinine in the treatment of malaria is a genuine example of chemotherapeutic action and, beyond Ehrlich & Guttman's (1891) empirical trial of methylene blue, no further progress in the chemotherapy of malaria took place until a precise testing method (Roehl, 1926b) rendered the laboratory examination of drugs feasible. Plasmochin (pamaquin, XXI) was first elaborated (Roehl, 1926b), based, it is said, on Ehrlich's early methylene-blue experiment, and followed, a few years later, by atebrin (mepacrine XXII) (Kikuth, 1932), which is said to have been based not on methylene blue but on acriflavine, the Germans being impressed with Browning's exploitation of acriflavine during the first World War. Quinine and atebrin dominated the therapy of malaria until the entry of Japan into the late war rendered the former unobtainable, and an added stimulus was thereby given to the search for still further antimalarial drugs. Shaking themselves free from the tradition that antimalarial activity should be sought among derivatives of quinoline and acridine, Curd, Davey & Rose (1945) of Imperial Chemical (Pharmaceuticals), Ltd. accomplished a remarkably successful search with the ultimate production of paludrine (XXIII), which is the most versatile antimalarial drug yet discovered. Recent American work has revealed promising activity in resochin (XXIV), which may be regarded as being derived from mepacrine (XXII) by ablation of the methoxylated benzene ring, and a

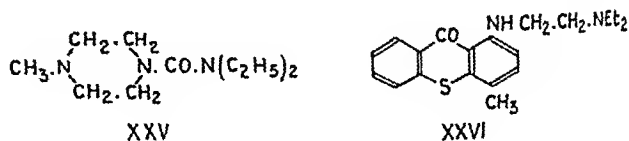
homologue, sontochin; these two drugs were encountered initially in the I.G. laboratories but were not brought into full production by the Germans because of economic war-time difficulties.



#### Chemotherapy of Helminthiasis

Numerous locally acting drugs are known which will expel parasitic worms from the gastro-intestinal tract but it is doubtful if any of these compounds conform to the usual criteria of chemotherapeutic agents, and the lack of suitable experimental animals in which the infections can be maintained and studied has hampered research on the chemotherapy of helminthiasis. Within the past year, however, notable advances in the chemotherapy of filariasis have emerged from the use of a natural filarial infection of cotton rats for the routine examination of drugs. A number of compounds of the cyanine-dye type were first shown to be active in the cotton rat (Welch *et al.* 1947; Brooker & Sweet, 1947), and still more recently, marked activity has been discovered among piperazine derivatives, out of which hetrazan (XXV) has been selected for further study (Hewitt *et al.* 1947).

Miracil (XXVI), which was found to be active in experimental schistosomiasis, has proved disappointing in human clinical trials.



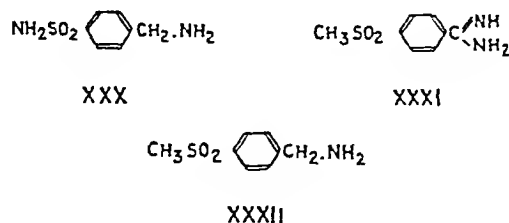
#### Chemotherapy of Bacterial and Virus Infections

##### Antibacterial Chemotherapy

In discussing antibacterial agents it is customary to think in terms of disinfectants, antiseptics and chemotherapeutic agents but, strictly speaking, the one type merges with the other in the order given and differences are relative ones depending upon toxicity to the host. Disinfectants are usually gross and indiscriminate poisons for cells and need not be further considered here. Antiseptics are usually applied topically and, as they are frequently of such low

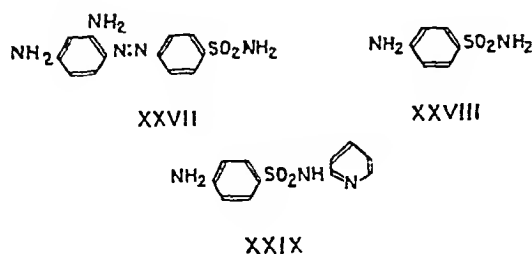
toxicity to the cells of the host that they may be used with caution on sensitive tissues, they can often be classed with the chemotherapeutic agents. Bacteria, in contrast with protozoa, are fairly rigid and physically resistant cells but the advent of sulphonamides and penicillin has shown systemic bacterial infections to be vulnerable to successful chemotherapeutic attack. The work of Browning and his collaborators on the acridine antiseptics was a feature of the 1914-1918 war and further vigorous study by Albert and his colleagues (1945) in Sydney has extended our knowledge of this field. The use of the quinine derivative optochin in the chemotherapy of pneumococcal septicaemia in mice (Morgenroth & Levy, 1911), however, was the only known example of the cure of a generalized invasive bacterial infection prior to the introduction by Domagk of the sulphonamides. Modelling their work on Eisenberg's (1913) examination of the antibacterial action of azo-compounds *in vitro* and on the well-known azo-pyridine urinary antiseptics (Hörlein, 1935-6), Mietzsch and Klarer decided to use the azo-benzene molecule as a versatile carrier of substituents, the general method of synthesis being diazotization of an aromatic amine and coupling with another component. Klarer (1943) has given a clear account of the plan of campaign which helps one to understand in some measure the mental reserve which the German workers showed at first to the idea that prontosil (XXVII) was broken down in the body to give sulphanilamide (XXVIII), the substance responsible for the systemic antibacterial activity of the original dye (Tréfouël, Tréfouël, Nitti & Bovet, 1935). Following the lead set in the May and Baker laboratories, the introduction of heterocyclic radicals into the sulphonamide group led in succession to sulphapyridine (XXIX), sulphathiazole and the sulphapyrimidines of increasing efficacy and diminished toxicity, and the maximum degree of efficiency in this group appears to have been reached in the pyrimidine derivatives. The medical uses of the sulphonamides, as well as their limitations, are well known and require no elaboration here, except to remark that their "spectrum" of activity is largely confined to gram-positive aerobic organisms.

Evans, Fuller & Walker (1944, 1945) showed that *p*-methylsulphonylbenzamidinium (V187) (XXXI) and *p*-methylsulphonylbenzylamine (V335) (XXXII) hydrochlorides were similar to marfanil in their biological effects, and, unlike the case with the so-called "sulphonamides", the antibacterial action of these three drugs is not interfered with by *p*-aminobenzoic acid.

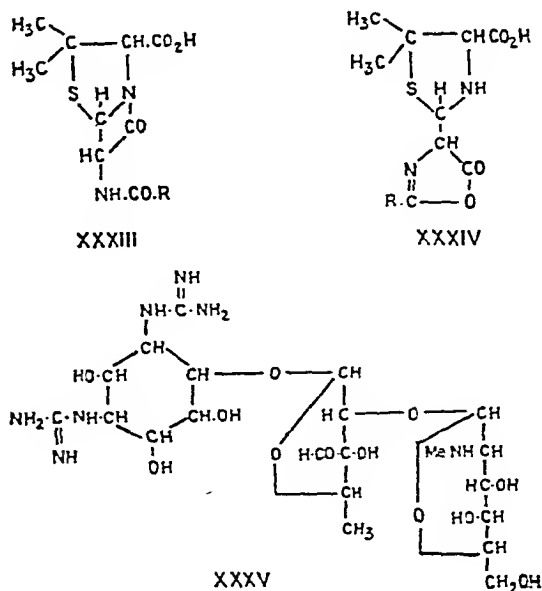


### Antibiotics

Although knowledge of microbial antagonisms involving pathogenic organisms goes back to Pasteur, attention was only sharply focused upon this "unassuming commonplace of Nature" by Florey and Chain's successful development of the penicillin produced by Fleming's historic contaminant. The range of activity of penicillin among bacteria and spirochaetes and its lack of toxicity to the host alike distinguish it as the most remarkable chemotherapeutic agent yet discovered. On the chemical side it has proved one of the most tantalizing of natural products ever investigated. Degradation gave two readily recognized fragments,  $\beta$ , $\beta$ -dimethylcysteine and an N-acylated-glycine derivative, but putting the pieces together again to give penicillin has been the alluring but discouraging task of numerous chemists for the past few years both in this country and in the USA. Only traces of antibacterial activity were detected in the products of synthesis and, even if du Vigneaud and his collaborators (1946) have isolated the substance responsible for the small degree of



It was found by Klarer (1941) and Domagk (1942) that interposing a methylene group between the aromatic amino group of sulphanilamide and the benzene ring markedly modified the antibacterial "spectrum" and increased greatly the action of the sulphonamide type of drug on anaerobic organisms of the *Clostridium* group; the resulting drug, marfanil (XXX) hydrochloride, came into wide use in the german army for the prophylactic treatment of wounds. Approaching from an entirely different angle,



activity found and have shown it to be penicillin, the synthesis affords no unequivocal proof of structure. The unorthodox  $\beta$ -lactam structure (XXXIII) for the penicillins is considered to represent their structure more satisfactorily than the oxazolone-thiazolidine formula (XXXIV), R being different in different penicillins.

Chemical engineering has accomplished a remarkably fine feat in the large-scale production of penicillin, coping, as it has had to do, with the necessity for working under sterile conditions, with the labile nature of penicillin, and with the necessity for training personnel in methods hitherto unknown on such a scale. Of other antibiotics, streptomycin is the only one which appears to have established itself as therapeutically of value, although gramicidin and tyrothricin have had a limited application in medicine. The chemical nature of streptomycin has been worked out in American laboratories but, considering the structural formula (XXXV) for streptomycin and that of the penicillins, the prognosis for ultimate preparation synthetically is even less bright than with the penicillins.

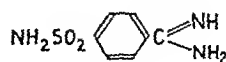
Present-day search among the metabolic products of moulds and other micro-organisms for therapeutic agents gives added interest to Samuel Butler's satire on a convert to Sir Kenelm Digby's<sup>2</sup> sympathetic therapy:

Learned he was in med'c'nal lore,  
For by his side a pouch he wore,  
Replete with strange hermetic powder,  
That wounds nine miles point-blank would solder;  
By skilful chymist, with great cost,  
Extracted from a rotten post;

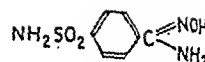
*Hudibras, Part I, Canto II.*

#### *Chemotherapy of Rickettsial and Virus Infections*

We have seen how the more-highly organized protozoal pathogens were the first to come under the control of chemotherapy and then later, descending the scale of biological differentiation, antibacterial chemotherapy became a practical reality. All these organisms, however, lead a free and independent existence and when we descend the scale still further to the rickettsiae of typhus and to the viruses we are dealing with parasites which are poorly endowed with synthetic abilities and which depend upon an intracellular environment for growth and multiplication. The position of the chemotherapy of rickettsial and virus infections has recently been assessed by Andrewes & King (1946) and by Findlay (1948), who have indicated the leads that are available. Andrewes and his colleagues (Andrewes, King, van den Ende & Walker, 1944; Andrewes, King & Walker, 1946) have shown that *p*-sulphonamidobenzamidine (V147) (XXXVI) and *p*-sulphonamidobenzamidoxime (V186) (XXXVII) hydrochlorides have a marked chemotherapeutic action in experimental typhus but human clinical trials, carried out in the wake of battle, were disappointing. A number of American workers have found massive doses of *p*-aminobenzoic acid to be of value in the treatment of some kindred diseases (Rocky Mountain spotted fever, scrub typhus) and dyes of the methylene-blue type have been studied experimentally with success. Penicillin, too, in massive doses has been reported as being active in experimental typhus.



XXXVI



XXXVII

#### *Chemotherapy of Cancer*

In cancer, chemotherapy has a problem which may well prove to be quite insuperable since the cancer cell, after all, is only a modification of the normal somatic cell, and "the conversion of a normal into a malignant cell is possibly brought about by a re-orientation of enzyme constitution of such a kind as would not necessarily involve any great change in gross protein-structure or in immunological specificity" (Haddow, 1947). On the other hand, the difference between sensitive and drug-resistant strains of the same species of bacteria can be similarly defined and we know that the appropriate drug will select and destroy the former strain, leaving the latter relatively unharmed. It has been suggested (Dubos, 1944) that certain gram-negative bacilli in their behaviour toward many types of antiseptics behave much more like animal-tissue cells than do other micro-organisms, and it may be that the chemotherapy of gram-negative infections will eventually suggest methods of approach to the chemotherapy of cancer.

On the practical side, which has been reviewed by Haddow (1947), it has been shown that oestrogens favourably influence cancer of the prostate, and there have been a number of studies of the effect of mitotic poisons on the growth of tumours. The specific cytotoxic effects of the chloroethylamine vesicants, which emerged from war-time biochemical study of these agents, suggested an investigation of their effects on malignant disease in man but it is still too soon to assess the results, and the same applies to the use of urethane in leukaemia.

#### *Theories of Chemotherapy*

Starting from the conception that all biological events are to be interpreted as chemical processes, Ehrlich postulated that "corpora non agunt nisi fixata" and considered that the ideal chemotherapeutic agent should be maximally parasitotropic and minimally organotropic, that is to say, it should have a great affinity for the protoplasm of the parasite and as little affinity as possible for the cells of the infected host. Although he realized that such absolute discrimination would not be possible as is the case in immunology where antibodies are exclusively parasitotropic and "nach Art von Zauberkugeln ihr Ziel selbst aufsuchen", he set himself the ideal of a "therapia sterilisans magna" and sought a drug so powerful that one single treatment should kill all the infecting parasites in a treated host and leave the host unharmed. Ehrlich interpreted his results in terms of his side-chain theory and in terms of receptor groups on the parasites specific for functional groups in the molecules of chemotherapeutic drugs—cellular -SH groups, for example, being the receptors fixing arsenicals to susceptible trypanosomes. In anticipation of modern work, he clearly pictured the possibility of drugs hindering the uptake of essential metabolites and gave a "grobes Beispiel" in a letter to his cousin, Carl Weigert, in 1898 (see Heymann, 1928); his theory of "athrepsy",

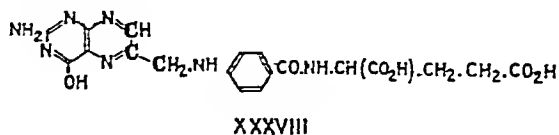
<sup>2</sup> Sir Kenelm Digby (1603–1665), an astrochemist, was one of the original Fellows of the Royal Society and a member of what is readily recognized today as the first National Committee for Chemistry.

in fact, accommodates the idea of interference by a drug with a metabolic process. It is obvious, however, that ultimately, any antiseptic action results in the alteration of essential metabolic events.

Chemotherapy has remained essentially an experimental science and such theories as there are, and they are not many, have been evolved to explain observations and not to pave the way for fresh discoveries. This is scarcely surprising when one considers that the biochemistry, and particularly the enzymology, of micro-organisms is still, relatively speaking, in its infancy; the attack on the problem of bacterial nutrition through the analysis of complex empirical media only began to bear fruit little more than a decade ago (see Knight, 1945). Further impetus to theories of chemotherapy came when Woods (1940) showed that a substance isolated from yeast extracts capable of antagonizing the antibacterial action of sulphanilamide had properties recalling those of *p*-aminobenzoic acid, which itself has this anti-sulphanilamide activity. The great similarity in the formulae of sulphanilamide and *p*-aminobenzoic acid led Fildes (1940) to state with greater precision than anyone previously that a drug might interfere with an essential metabolite and so inhibit growth, and that it might do so in one of three ways, of which the most interesting was by competition for an enzyme associated with the essential metabolite. It was postulated that *p*-aminobenzoic acid, whose biological significance first came to light in this extremely indirect manner, was an essential metabolite for certain bacteria and that, in virtue of structural similarity, sulphanilamide, and, of course, sulphonamides generally, displaced it from its enzyme and thus stopped an essential line of metabolic events. Such an inhibition requires an inhibitor so closely related in chemical structure to the essential metabolite that it can fit the same enzyme and yet sufficiently unrelated to be devoid of essential metabolic activity. Further work has shown this simple sulphonamide—*p*-aminobenzoic-acid thesis to be an over-simplification (Henry, 1943, 1944) and, although Fildes suggested that other chemotherapeutic agents might be sought by modelling drugs on known essential metabolites, further intensive work (see Roblin, 1946) has so far failed to produce a single therapeutic agent of practical value, but the qualitative generality of the phenomenon is not in doubt. Although analogues of essential growth-factors frequently inhibit *in vitro* growth of bacteria, they fail to show any chemotherapeutic activity because the metabolites on which they are based are normal constituents of the body-fluids of animals.

The discovery of *p*-aminobenzoic acid in a combined form in compounds of the folic-acid group, such as liver *Lactobacillus casei* factor (pteroylglutamic acid) (XXXVIII), was an event of considerable biochemical interest. There is evidence to show that many bacteria can synthesize folic acid (Sarett, 1947) and in some cases this has been related to the *p*-aminobenzoic acid content of the medium (Mayer, 1943; Mills *et al.* 1944). Recent findings also indicate that sulphonamides inhibit the synthesis of pteric acid from *p*-aminobenzoic acid in the case of enterococci (Lampen & Jones, 1946). If O'Meara, McNally & Nelson (1944, 1947) are correct in their suggestion that reductone,  $\text{CHO.C(OH):CH(OH)}$ , is the strongly-reducing non-sulphydryl substance found in bacterial cultures during the logarithmic phase of growth, it may well be that reductone

provides the 3-carbon unit indicated in bold type in XXXVIII and that sulphonamides interfere with the synthesis of pteric acid from *p*-aminobenzoic acid by competing with the latter for reductone, giving rise to biologically-inert analogues of pteric acid (Forrest & Walker, 1948).

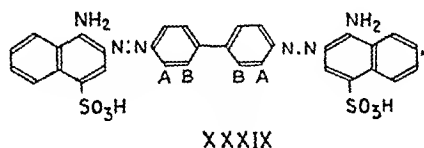


Considerable success has attended the correlation of physicochemical properties of drugs with trends in the biological effects which they produce. For example, the experimental correlation of the acid dissociation constants of sulphonamides with *in vitro* antibacterial activity has shown that maximum activity is found in those drugs which are approximately 50% ionized at the pH of the medium considered (Bell & Roblin, 1942), the shape of the curve obtained on plotting these properties against each other indicating the operation of two factors; a plausible, but incomplete, explanation (Cowles, 1942) is that these drugs are absorbed in the undissociated form and that it is the ion which is active, although diaminodiphenyl sulphone and sulphaguanidine, which have no acidic properties, are embarrassing exceptions. Albert and his colleagues (1945) have shown that, among the aminoacridines, once a minimal degree of basic strength has been attained further increase does not influence antibacterial activity which has already reached a maximum, suggesting a simpler relation between activity and chemical constitution in this series than in the case of the sulphonamides; there is much to indicate that ion-exchange and acid-base neutralization phenomena form the basis of the biological effects of this and certain other groups of antibacterial agents.

The difficulties facing a theoretical approach to chemotherapy as a guide to synthetic operations by the organic chemist are well illustrated by the unfolding of events in the development of paludrine (XXIII). Had one of the suggested working hypotheses been followed unremittently we might, for example, have had a number of extremely powerful antagonists of riboflavin, but we should not have had paludrine. Again, refined speculations in terms of the theory of resonance are of doubtful significance as a guide to the design of new drugs; it is noteworthy that the lower (methyl) homologue of paludrine, to which such considerations apply not one whit less than they do to paludrine itself, is not an antimalarial (Curd & Rose, 1946). Just as in the case of Bayer 205 where the two methyl groups (italicized in IV) are necessary for high biological activity and must occupy the positions shown and no others, so also with the lower homologue of paludrine, the two methyl groups which transform the methyl radical,  $-\text{CH}_3$ , into the isopropyl group,  $-\text{CH}(\text{CH}_3)_2$ , bring out the desired biological activity. One may take an illustration from another branch of applied chemistry where the participants are the cellulose fibre and three related dyestuffs. Congo-red (XXXIX, A and B being hydrogen atoms) has the power of dyeing cotton directly, although the colour is unstable to acids on account of the indicator nature of the dye. Substitution of two methyl groups at the two positions A,



giving benzopurpurin 4B, affords a similar substantive dye with increased stability to acid, but, on the other hand, similar substitution of methyls at the two positions B destroys substantivity altogether, the resulting dye showing no affinity for the cellulose fibre.



In their extensive study of trypanocidal dyes, Nicolle & Mesnil (1906) found that dis-azo dyes of the trypan-blue and trypan-violet type fell clearly into two classes, those that dyed cotton directly and those that did not; trypanocidal dyes fell in the first group and trypanocidal activity, as might be expected, was even more narrowly selective than substantivity. When simple chemical changes in molecules produce fundamental alterations in their behaviour towards the relatively simple and homogeneous cellulose fibre, it seems premature to theorize in terms of the much more complex living cell; in the ultimate analysis, the problem of biological specificity will yield only to experiment and not to argument.

Once the primary observation of biological activity is made on a new type of compound, (and this, of necessity, must be made empirically), the synthetic organic chemist is usually able, in the exercise of his craft, to provide a variety of related types. From the body of circumstantial evidence regarding structure and activity which grows thereby, it is possible with consequent economy of effort to narrow the search for maximum biological activity. In this cursory review of chemotherapy no reference has been made to the participation of the host but it goes without

saying that, whether the chemotherapeutic agent acts directly on the infecting parasites or indirectly through a blockade of some kind, the final act in the recovery process is performed by the body, which may or may not have been an active participant in earlier stages as well.

It is only as our knowledge of the biochemistry of micro-organisms grows that we may expect to reach a fuller understanding of chemotherapeutic processes and that the gaps in chemotherapy may be filled in. If we long ago abandoned the use of Ehrlich's nomenclature with its multiplicity of receptors, we must, at least, look upon it with indulgence, for, as Dale (1923) has pointed out, "Ehrlich's theory will always deserve the credit of having provided a vigorous stimulus to the investigation of problems which, without some kind of working hypothesis, might well have seemed beyond the reach of experimental attack". The intervening years have given us a wide variety of new drugs and control over an ever-increasing number of pathogenic organisms. None of our chemotherapeutic agents, however, is so good as to be incapable of improvement and we must continue to seek for better ones, with enhanced margins of safety and presenting greater convenience in administration. Of penicillin we can entertain no criticism of its remarkable powers as a drug but its production is extravagant in man-power and material, and so the search for new synthetic antibacterial agents will go on, using penicillin as the yard-stick by which the newer drugs are measured. It may be that the chemotherapy of gram-negative infections will be suddenly opened up by a discovery matching the introduction of the sulphonamides, and there are signs that the practical chemotherapy of tuberculosis may not be long delayed. The fruitful collaboration of chemistry and medicine, which has given the physician the power to control with certainty infections which only a decade ago would have proved fatal, gives one a feeling of sober confidence that yet more benefits to humanity will accrue from their continued association.

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Continued at foot of page 369

## SOME MEDICAL CONTRIBUTORS TO CHEMISTRY

TREVOR I. WILLIAMS B.A. B.Sc. D.Phil.

*Deputy Editor, Endeavour*

The debt of medicine to chemistry is well known, and one is constantly reminded of it by accounts of new drugs and anaesthetics, new materials for the construction of medical instruments and equipment, new knowledge of the processes that occur in living cells, and in many other ways. It is, however, much less generally appreciated that chemistry owes a very considerable debt to medicine, for many chemical discoveries of fundamental importance have been made by men whose academic qualification was the M.D. degree and many of whom carried on their chemical investigations while actively practising the profession of medicine. The occasion of the Chemical Society's recent centenary celebrations is an appropriate time to review this subject, for of the seventy-seven original members of the Society no less than fifteen were medical men.

For many centuries science and medicine were so closely interwoven that, especially among the humbler practitioners, it is now often impossible to distinguish one from the other. A slight acquaintance with contemporary knowledge of natural phenomena was frequently sufficient to establish

a reputation as a healer; the term physician did not necessarily connote any specific qualifications and it was only in the higher ranks of the medical profession that any sort of control was enforced. The universities granted medical degrees from a very early stage in their history, and after 1518, when the Royal College of Physicians was founded, physicians practising within seven miles of London had to have the M.D. degree of the universities of Oxford or Cambridge. In England, membership of the Barber-Surgeons' Company or of the Society of Apothecaries became recognized as a definite professional qualification and similar professional organizations were established in other countries. The Barber-Surgeons' Company was formed in London in 1308 and the connexion between barbers and surgeons was not dissolved until 1745, when the College of Surgeons was formed and it was ordained that "no person using any shavery or barbery in London shall occupy any surgery, letting of blood, or other matter, except only drawing of teeth." The Apothecaries were formerly associated with the Grocers but they formed a separate Company in 1617. It will be seen therefore that in England an organized profession of medicine scarcely existed before the fourteenth century, when chemistry was still at the alchemical stage. Not until the sixteenth century did chemistry appear in anything like its modern form.

### *Paracelsus and his Successors*

The first great figure linking chemistry with medicine after the alchemical era was Paracelsus (1493-1541), physician to the city of Basle. Among his many remarkable and sometimes unattractive characteristics was a profound contempt for authority. He used his own authority to order the destruction of existing medical and alchemical textbooks and placed his own views in their place. His greatest contribution to chemistry was his proclamation that the transmutation of base metals into gold must not be

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the sole aim of chemical experiments, though he believed that transmutation was a possibility. He taught that for the treatment of disease the pure substances produced by chemical methods were preferable to the empirical and often noxious brews then in common use. Paracelsus introduced many inorganic substances—including compounds of mercury, lead, sulphur, iron, arsenic, and copper—into general medical practice and was thus the founder of medical chemistry, or iatrochemistry as it is called.

Among medical men Paracelsus had several worthy successors to continue his iatrochemical doctrines. Angelo Sala (1575–1640) was physician to the Duke of Mecklenburg and also a chemist of repute. His *Opera medico-chemica* was published in 1647. Among his contributions to chemistry may be mentioned a clear description of ammonia and ammonium chloride and the preparation of nitric acid by the action of sulphuric acid on saltpetre. He was described by Conring as “the first chemist who ceased from trifling.”

Another of the great iatrochemists was Johan van Helmont (1577–1644). Although he came of a noble family, and had estates in Brabant, he chose to give all his property to his sister and to devote himself to serious study. He took his M.D. degree in 1599. Thereafter he turned his attention to almost every branch of the arts and science and made several notable discoveries in chemistry. Perhaps his greatest achievement was his recognition of the nature of gases and his demonstration that there are several different kinds of gases. Earlier chemists had almost entirely ignored the gaseous products of their experiments, no doubt because of the difficulty of handling them with the apparatus at their disposal. Geber, for example, in describing an experiment in which ammonia is evolved, merely states that the nose should be averted from the reaction vessel. Van Helmont prepared carbon dioxide (rediscovered by Black in the eighteenth century as “fixed air”) by the action of acid on marble. He distinguished between gases and vapours. He introduced the use of the temperatures of freezing and boiling of water as fixed thermometric points. More important still, he emphasized the importance of the balance in chemical research. Although he never freed himself entirely from the ideas of the alchemists, and devoted a great deal of time to a search for the universal solvent or alcahest, van Helmont was a shrewd and careful observer and certainly one of the greatest chemists of his day.

#### *Iatrochemists of the XVII Century*

Among others of the early iatrochemists may be mentioned Oswald Croll (1580–1609), who was physician to Prince Christian of Anhalt Bernberg. He was responsible for the introduction into medicine of succinic acid, potassium sulphate, antimoniac acid, calomel, and silver chloride. Guerner Rolfinck (1599–1673) was a physician with very catholic interests in science. He was successively professor of Anatomy, Surgery, Botany, Practical Medicine, and Chemistry at Jena; this is perhaps an unequalled record of academic versatility. According to Stahl, Rolfinck was responsible for having “brought chemistry into shape, deduced its operations from causes conformed into Nature and reason, and laid a foundation on which many subsequently built.” Adrian von Mynsicht (1603–1638) prac-

tised medicine at Helmstadt. He discovered tartaric acid and used antimony sulphide and cream of tartar for the preparation of tartar emetic. François de la Boë, better known as Franciscus Sylvius (1614–1672), a disciple of van Helmont, practised medicine at Amsterdam. At his instigation the first chemical laboratory in Europe was built at Leyden, where he was professor of chemistry. He added considerably to knowledge of salts and their formation. Thomas Willis (1621–1675), the great authority on the anatomy of the nervous system, was also an able chemist. After graduating at Christ Church, Oxford, he practised in London. He investigated the preparation of ether and succinic acid.

John Mayow (1643–1679) was a doctor of laws of Oxford University. He practised medicine in Oxford and in Bath, though he does not seem ever to have gained the M.D. degree. He was in a sense the discoverer of oxygen, “officially” discovered independently by Priestley and Scheele a century later, for he recognized that there is a constituent of air which is concerned with both combustion and respiration.

In the year after van Helmont's death another great iatrochemist was born. He was Nicholas Lémery (1645–1715), who became a doctor of medicine of the University of Caen. Lémery's chemical lectures at his laboratory in the Rue Galande in Paris attracted not only the cream of French society but also numerous students from the whole of Europe. His textbook of chemistry, *Cours de chymie*, published in 1675, was a great success. It passed through thirteen editions in his own lifetime and remained a standard work for more than a century. Lémery was a fine experimentalist and his work did a great deal to clarify contemporary ideas on the preparation and properties of many compounds. He distinguished between organic and inorganic substances. Like van Helmont he appreciated the use of the balance and noted the increase in weight which occurs when lead and certain other substances are calcined. Although he found it difficult to reconcile this with the phlogiston theory he did not understand the real nature of combustion. While in Paris, Lémery is said to have made a handsome living by selling a cosmetic—“le seul Magistere de Bismut”—which was apparently a form of bismuth oxychloride.

#### *Stahl and the Phlogiston Theory*

Georg Stahl (1660–1734) is notable for having developed the phlogiston theory of combustion, postulated originally by Becher. Although the phlogiston theory proved false when subjected to the test of experiment it was in fact a good theory, and its use as a working hypothesis considerably advanced chemical knowledge. Indeed, it was in effect a negative expression of the correct theory of combustion, for the phlogiston theory becomes intelligible if, for the word phlogiston, we substitute “absence of oxygen.” Stahl was a graduate of Jena who became professor of medicine at Jena and later physician to the King of Prussia.

Although Lémery had distinguished between organic and inorganic compounds, Hermann Boerhaave (1668–1738), a Dutch physician, is generally recognized as the founder of organic chemistry. He was professor of medicine and botany, and later professor of chemistry, at the University of Leyden. His *Elementia chemiae* was published in 1724.

The glass and optical industries owe a considerable debt to John Bevis (1693–1771), a London physician who was the first to make glass with borax. He noted that this gave a glass with a high refractive index and thus pointed the way to the achromatic combinations which were developed many years later.

#### *Scottish Pioneers*

Another physician who made great contributions to chemistry, and founded the famous Scottish school of chemistry, was William Cullen (1710–1790). He began his medical career as a ship's surgeon and later became an apothecary's assistant in London. He then practised as a surgeon at Hamilton, Lanarkshire, taking his M.D. degree at Glasgow in 1740. In 1756 he was appointed professor of chemistry at Edinburgh. Among his contributions to chemistry was the discovery that liquids become cold when they evaporate and when certain substances are dissolved in them. Pre-eminent among Cullen's many distinguished pupils was Joseph Black (1728–1799). Black took his M.D. degree in 1754, submitting a chemical thesis, *De humore acido a cibis orto et magnesiae alba*, for examination. Black's work on the relationship between carbon dioxide and the oxides and carbonates of magnesium and calcium considerably clarified contemporary ideas on the nature of chemical combination and also emphasized the importance of quantitative work. He developed Cullen's work on latent heat and his work in this field led to Watt's construction of steam engines. Besides carrying out his extensive chemical investigations, Black found time to look after a large general practice in Glasgow. He was the first to hold the position of Physician to His Majesty in Scotland.

Although the work of the Italian physician Luigi Galvani (1737–1798) was primarily in the physical field, it had nevertheless a considerable influence on the development of physical chemistry. His discoveries formed the background to the electrochemical researches of Michael Faraday, which in turn led on to an understanding of the process of electrolytic dissociation. Hermann von Helmholtz (1821–1894) has a similar claim to consideration. After a short career as an army surgeon he became professor of physiology at Königsberg, Bonn, and Heidelberg successively, but in 1871 his physical researches gained for him an appointment as professor of physics in Berlin. His discoveries—exemplified by his enunciation in 1847 of the conservation of energy in closed systems and the Gibbs-Helmholtz equation relating to chemical reactions—have materially advanced the progress of chemistry. In the same class, too, is Julius Mayer (1814–1878) who, like Cullen, began his career as a ship's surgeon, later taking up a medical appointment in his native town of Heilbronn. He was the first to calculate the mechanical equivalent of heat, a constant of great importance in physical chemistry. Mayer is reputed to have conceived his work on the mechanical equivalent of heat while on a voyage to the East Indies. While in the tropics he had occasion to bleed several members of the crew and he was struck by the unusual redness of their blood, indicating a low consumption of oxygen. From this he was led to consideration of the energy released in the metabolism of food and thence to determination of the mechanical equivalent of heat.

#### *Carl Scheele: The XVIII Century*

The Swedish apothecary Carl Scheele (1742–1786) was responsible for discovering many new chemical substances. The long list of these includes arsenic acid, hydrogen sulphide, arsenic sulphide, chlorine, hydrofluoric acid, and lactic, oxalic, citric, and tartaric acids. He also carried out an extensive investigation of the properties of manganese. He anticipated Priestley in the discovery of oxygen and came close to discovering the nature of combustion.

Work on the study of gases was advanced by Daniel Rutherford (1749–1819), whose thesis for the M.D. degree at Edinburgh defined the difference between carbon dioxide and nitrogen. The acceptance of a chemical subject for the M.D. degree again emphasizes the close connexion that then existed between medicine and chemistry. Rutherford was the first to prepare nitrogen, which he obtained by removing oxygen from air by combustion. Priestley independently obtained nitrogen at about the same time and—a sign of his lifelong adherence to the phlogiston theory—called it “dephlogisticated air.”

Another important figure in the chemical life of the late eighteenth century was Thomas Beddoes (1760–1808). He obtained his M.D. degree at Oxford and afterwards became University Reader in Chemistry. Subsequently he founded the Pneumatic Institute at Clifton, Bristol, primarily with the intention of studying the possible therapeutic effects of inhaling gases. As his assistant he engaged the young Humphry Davy (1778–1829), who at that time was proposing to go to Edinburgh to study medicine. Davy became so absorbed, however, in his chemical work at Bristol—where his discoveries included that of the anaesthetic properties of nitrous oxide—that he eventually abandoned his original intention of qualifying in medicine. Lyon Playfair (1818–1898) was another great chemist who began his career with the intention of qualifying in medicine, an intention which he was forced to give up owing to a breakdown in his health.

A great part of our knowledge of the chemical properties of platinum, and the discovery of a satisfactory method of rendering the metal malleable, is due to William Hyde Wollaston (1766–1828). He graduated as an M.D. at Cambridge and from 1789 to 1800 carried on general practice in various places, finally settling in London. He then abandoned medicine for chemistry and within a few years his mastery of the intractable metal platinum won him a fortune of £30,000. He discovered also the metals rhodium and palladium.

In this catalogue of medical contributors to chemistry, brief mention might perhaps be made of Alexander Marcet (1770–1822), less because of his activities in the field of pure chemistry—where his chief service was in teaching—than because his wife, with his collaboration, did so much to interpret chemistry to the general public. The first of her popular science books, *Conversations in chemistry*, had enormous sales throughout Europe.

Among the greatest chemical figures of the early nineteenth century was Jöns Berzelius (1779–1848), a Swede who graduated in medicine at Uppsala in 1802. From 1807 onwards he taught medicine and pharmacy at Stockholm, adding chemistry to his course in 1815. It is as a chemist that he is remembered. Among the impressive

list of his achievements in chemistry may be recalled his long series of determinations of atomic weights, his experiments in electrolysis, his discovery of selenium, cerium, and thorium, his isolation of columbium and silicon, his introduction of the modern system of chemical symbols, his improvement of analytical methods, and his classification of minerals according to their chemical constitution.

The work of William Prout (1785–1850) on the determination of atomic weights by vapour density measurements, of which he published an anonymous account in 1815, proved of value in clarifying some of the uncertainties about atomic weights which existed in the early nineteenth century. His famous hypothesis—that all atoms are made up of hydrogen atoms and that the atomic weights are therefore very nearly whole numbers—proved incapable of substantiation at the time, but the discovery of isotopes nearly a century later showed that his idea had in fact some substance. Prout was a Gloucestershire man who qualified in medicine at Edinburgh and practised in London.

Although recent study of the contemporary literature tends to diminish the significance which has been attached to his conversion of inorganic ammonium cyanate into organic urea, the chemical researches of Friedrich Wöhler (1800–1882) are well worthy of notice in other respects. His isolation of aluminium in 1827 and of beryllium in 1828 are of particular interest. He also devised a method for manufacturing nickel and carried out important investigations on the phenomenon of isomerism.

#### *Some Irish Chemists*

Among Irish chemists of the nineteenth century Sir Robert Kane (1809–1890) was pre-eminent. At the age of thirty-five he had established a European reputation as a chemist but, unfortunately for chemistry, he was also an able administrator and educationist and as such attracted the attention of Sir Robert Peel, who induced him to take up political work. After qualifying in medicine Kane went to Paris to study pharmacy in 1830. In the following year he was appointed professor of chemistry at Apothecaries' Hall, Dublin. In the same year, at the remarkably early age of twenty-two, he was elected to the Royal Irish Academy. Among his chemical discoveries may be mentioned the synthesis of mesitylene from acetone, the recognition of the ethyl radical, the use of calcium chloride in the purification of methanol, his researches on archil and litmus, and the investigation of mineral manganese arsenide, which was subsequently named Kaneite in his honour. He was a gifted writer and his textbook of chemistry was regarded as the best of its day. In the political field, another book, *The industrial resources of Ireland*, created an equally great impression. He was the founder of the *Dublin Journal of Medical and Chemical Science*, which is still published in the form of a purely

medical journal with the title of *The Irish Journal of Medical Science*.

Another distinguished Irishman of the same period was Thomas Andrews (1813–1885), who took his M.D. degree at Edinburgh in 1835. After practising for a time in Belfast he was elected professor of chemistry in Queen's College, Belfast, in 1849, and held this post for thirty years. Andrews is best known for his important work on the liquefaction of gases and his discovery of the existence of critical temperatures and pressures.

#### *The Chemical Society Founded*

Among the great chemical problems of the early and middle nineteenth century was that of discovering how atoms are linked together to form molecules. For our modern conception of valency much is owed to Friedrich Kekulé, who was for a time a lecturer in chemistry at St. Bartholomew's Hospital, London, but many outstanding problems were clarified by the work of William Odling (1829–1921). Odling qualified in medicine in 1851 and then went to Paris to study chemistry. On his return to England he was engaged in laboratory work and in lecturing on chemistry at Guy's Hospital. In 1868 he succeeded Faraday as Fullerian Professor of Chemistry at the Royal Institution. Later he succeeded Brodie in the Waynflete Chair of Chemistry at Oxford and did not retire from his long life of active chemical work until 1912.

Odling was among the last of the great chemists whose academic qualification was a medical degree. By the middle of the nineteenth century, facilities for the teaching and practice of chemistry and for the exchange of information had become sufficient to meet the rapidly growing interest in the subject without dependence upon the medical profession. The most significant event in this respect was the foundation of the Chemical Society in 1841; for the meetings and publications of the Society proved an excellent medium for the discussion of controversial chemical subjects and the exchange of information. In 1845 the Royal College of Chemistry was founded in London, with W. A. von Hofmann as its first professor. The first university chemical laboratory was opened in Oxford in 1854 and at Cambridge in 1887, though at both Universities chemistry had been taught for some two hundred years previously. A school of chemistry was formed in Manchester in 1851. Adequate training thus became available to all potential chemists, without need to take the medical course.

Medical contributions to chemistry still continue, however, though in a rather different way. Collaboration between physician and chemist, the one venturing some distance into the now vast field of chemical knowledge and the other essaying to master some knowledge of medicine, has proved of great advantage to both, particularly in the study of physiologically-active substances such as antibiotics, vitamins, hormones, and carcinogens.

\* \* \*



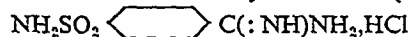
## TYPHUS AND CHEMOTHERAPY

Prof. A. W. DOWNIE

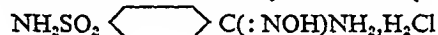
*University of Liverpool*

This report<sup>1</sup> covers a large part of the work on typhus carried out between 1941 and 1946 at the National Institute for Medical Research, Hampstead, London, and at the Royal Army Medical College Emergency Vaccine Laboratory, Everleigh, Wilts. Publication of many aspects of the work had been withheld for security reasons. The largest part of the report is concerned with observations made during clinical trials of two drugs, in North Africa and Italy. These substances had given highly promising results in laboratory tests recorded in 1944 by Andrewes, King, van den Ende & Walker. The two substances were:

*para*-sulphonamidobenzamidine hydrochloride (V 147)



*para*-sulphonamidobenzamidoxine hydrochloride (V 186)



### Toxicity of V 147 and V 186

The results of toxicity tests in mice, guineapigs, rabbits, rhesus monkeys and man are recorded in the first section by C. H. Andrewes, A. M. Begg & M. van den Ende. The maximum daily dose in g./kg. tolerated *per os* over several days was greater for mice (2) than for rhesus monkeys (0.25) or guineapigs (0.3). A daily dose of 0.13 g./kg. was tolerated by human volunteers without ill-effects.

### Chemotherapeutic Trials

Section II, comprising 118 pages, is a report by the British Army Typhus Research Team on chemotherapeutic trials in typhus fever in man and a report of the 1943–4 Naples typhus epidemic. The team began work in Algiers in July 1943 and although the number of cases available throughout the summer and autumn was small the experience gained was valuable. It was established that the drug V 186 did not produce an obvious clinical effect when given to patients in the second week of the disease. The cases were mostly in Arabs under the age of 40, with a gross mortality from typhus of only 11 per cent. Only one-third of the cases was admitted before the 8th day of the disease. If the diagnosis of typhus seemed likely on clinical and pathological grounds, alternate patients were given V 186. Of the entire group of 65 patients investigated, a final diagnosis of typhus was made in 21, other diagnoses being established in the remainder on the basis of clinical examination and

extensive laboratory investigations. Details of clinical course and laboratory findings are given in respect of the typhus patients. It was felt that V 186 did possibly cause a slow amelioration of the disease but the need for further observations on a large group of patients was obvious. One patient apparently developed kidney damage, either because of the effect of the drug alone, or because of the combined effect of the drug and the lesions of typhus.

### The Naples Typhus Epidemic 1943–4

The Naples outbreak developed in December 1943 and much of the work was transferred to that centre. The chemotherapeutic trial of V 186 was made on new cases admitted to hospital between 2 January and 9 February 1944, the period which included the time of maximal prevalence of typhus in the city (913 cases were reported during January). The American Typhus Commission was very active and co-operative. An analysis of the cases from December 1943–February 1944 showed that the mortality among 1423 cases was 13.9 per cent. There were however 12 deaths among the 50 control cases admitted to hospital and forming part of the trial. A detailed analysis of the clinical course, symptomatology, and physical findings in these cases is presented and tabulated. Similar data are given for 30 patients in the "treated" group: of these, 27 received V 186 and 3, V 147. In the final comparison of the 30 patients in the treated group with the corresponding 30 controls there were 8 in each group classified as severe and, of these, 7 in the treated group died and 5 of the controls. The two groups had been reasonably comparable in duration of illness prior to admission, in age and sex incidence and in symptomatology. In those who recovered there was no difference between the two groups in the duration of fever after admission to hospital. In considering possible toxic effects, vomiting was more frequent in the treated patients and in five a peculiar collapse or shock-like state occurred. There was clinical evidence that V 186 was probably exerting a toxic action on the kidney and in fatal cases severe tubular degeneration of the kidney was found. Penicillin was given to a few of the control cases but did not exert any marked beneficial effect on the course of the disease.

The results of pathological investigations carried out are given in some detail: strains of rickettsiae were isolated from 17 patients by inoculation of blood into guineapigs, and 11 were adapted to mouse lungs. Three attempts were made to isolate rickettsiae from the blood of patients who had been treated with V 186 for 24 hours or more, and all succeeded. Useful data are given on the development of agglutinins for murine and epidemic rickettsia and for *Proteus OX19* and *OX2* in 59 patients. Complement-fixation tests made on some of the sera against freshly prepared rickettsial suspensions gave positive results with epidemic, but negative with murine, antigens. The findings in relation to blood-counts and blood-chemistry are discussed and the morbid anatomy and histology, based on 24 autopsies, is described. As indicated above, tubular degeneration in the kidneys was much more severe in the treated than in the control series.

The reason for the failure of V 186 in the treatment of typhus in man and its success in the mouse is not quite clear and it is suggested that the elucidation of this difference might serve to explain the mode of action of the drug.

<sup>1</sup> [For particulars see Book Reviews.]

### Test for Neutralizing Power of Antirickettsial Sera

In section III, by M. van den Ende & K. C. Mills, experiments on a quantitative test for neutralizing antibodies against typhus rickettsiae are described. The method depends on the determination of the extent of the reduction in the number of focal lesions produced in the lungs of mice inoculated intranasally with rickettsial suspension mixed with progressive dilutions of serum. The inhibitory effect of serum was not noticeably increased by prolonging the contact of serum and rickettsiae for more than half-an-hour before inoculation into mice. The test gave fairly accurate results with sera which were sufficiently potent to reduce the focal-lesion count to 20 per cent., or less, of that in the controls. Many human sera studied, however, were not of this potency. With immune rabbit-sera against epidemic strains, neutralization of murine rickettsiae was poor compared to that against homologous rickettsiae. The reduction in the focal-lesion count was not dependent on the agglutination of rickettsiae. The mouse test gave more satisfactory results than the Giroud test of neutralization by intradermal injection of serum-rickettsiae mixtures into rabbits.

### Comparison of Typhus Vaccines

Section IV, by F. Fulton, M. van den Ende, W. J. Elford & K. C. Mills, is devoted to a study of laboratory methods for comparing the potency of typhus vaccines. The methods of preparation of four murine vaccines, two from yolk-sacs (A and B) and two from mouse lungs (C and D) of approximately equal rickettsial content, are described. Two of the vaccines were highly purified, one (A) from the yolk-sac by Craigie's ether method, the other (B) from mouse lung by the kieselguhr method which, in its improved form, is described in detail in the succeeding section. Photomicrographs of representative fields of the four vaccine-suspensions are reproduced on plate X. The vaccines were standardized after the number of rickettsiae present had been estimated by the microscopical examination of stained films. The potency of the vaccines was compared by: (a) active immunization of guineapigs by one intraperitoneal injection of vaccine; the animals were tested 37 days later by intraperitoneal injection of a yolk-sac suspension of living rickettsiae; (b) protection of mice by a single dose of vaccine against the toxic effect of a certainly fatal dose of rickettsiae injected intravenously; and (c) by the production of antibodies in vaccinated rabbits and guineapigs. The rabbits received three doses of vaccine intravenously at four-day intervals. The guineapigs were those used in method (a) and were bled for serum before the challenge dose of living rickettsiae was injected. The antibodies studied in sera of immunized rabbits and guineapigs were: rickettsial agglutinins, agglutinins for *Proteus OX19*, complement fixing antibodies, "antitoxins", and neutralizing antibodies. The titres of antibodies were lower in the guineapig sera than in the rabbit sera. *Proteus OX19* agglutinins were present in the rabbit sera only in small amounts—highest titre 1/40—and were not tested in the guineapig sera. By these methods, no significant difference in the antigenic potency of the four vaccines was detected and it is concluded that potency depends on the number of rickettsiae present and is independent of the soluble antigen. The power of a vaccine to protect mice

against the toxicity of rickettsiae injected intravenously affords the most convenient and reliable test for vaccine potency.

### Antigenic Structure of Typhus Rickettsiae

In section V (29 pages), a detailed serological study of the antigenic structure of typhus rickettsiae by F. Fulton & A. M. Begg is presented. The Wilmington murine strain and a Cairo epidemic strain (isolated in 1942) were used in most of the work. Immune rabbit- and guineapig-sera were obtained from animals after a single intraperitoneal infecting-dose of rickettsiae from yolk-sacs or mouse lungs. For some of the later experiments rabbits were immunized by intravenous injection of *Proteus OX19* suspension or by repeated intravenous injections of various rickettsial antigens. Agglutination tests and the complement-fixation reaction were used throughout. Purified suspensions for agglutination tests and for absorption of sera were prepared from rat- (murine strain) or mouse-lungs. Antigens for complement fixation were prepared in the same way, although yolk-sac antigens were also used in the experiments on soluble antigen. The working hypothesis adopted by the authors was based on the propositions: (i) that the antibodies formed in response to one antigen are not entirely uniform but vary in specificity to some degree, and (ii) that the heating of some antigens to 100°C. creates a new antigenic specificity.

From the results of their carefully-planned experiments with unabsorbed and absorbed sera, the authors reach the following conclusions: the surface antigen of the murine strain of typhus rickettsiae is similar to, but not identical with, the surface antigen of the epidemic strain; the murine rickettsial surface-antigen gives rise to a heterogeneous group of antibodies, some of which can react with the surface antigen of the epidemic strains; similarly the epidemic surface-antigen gives rise to antibodies, some of which react with the murine surface-antigen.

Boiling a rickettsial suspension so alters the surface antigen that it acquires a new serological specificity. Such degraded antigens have lost their strain-specificity. Rabbit and guineapig rickettsial antisera contain an antibody which reacts with boiled rickettsiae but this antibody is entirely distinct from the antibody which reacts with the undegraded rickettsiae. The *OX19* antibody of rabbit rickettsial antisera is entirely distinct from the antibodies to the undegraded surface-antigen of the rickettsiae, but it is a fraction of the group of antibodies which reacts with the boiled rickettsiae. Shaking a rickettsial suspension with ethyl ether provokes the release into the surrounding fluid of a soluble antigen which behaves as if it were a fragment of the surface antigen, though there is evidence that it is partially degraded.

### Case Reports and Drugs Tested

In appendix A (50 pages) are set out summarized reports of 13 representative cases which illustrate the respective features of severe, moderate and mild typhus treated with or without chemotherapy. An account of the postmortem findings and histology is given with the reports of the six fatal cases. Some of the histological lesions found in typhus cases are illustrated by excellent photomicrographs on plates II-IX. A second appendix gives a list of the

*Continued at foot of page 371*

## FACTOR ANALYSIS IN PSYCHOLOGICAL MEDICINE

Sir CYRIL BURT

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The application of statistical methods to problems of psychiatry is of quite recent origin. Yet it promises to throw a new and revealing light on many unsolved problems.

The idea of disentangling contributory causes by means of a statistical analysis is due to Galton. The fundamental technique is the calculation of a coefficient of correlation, which was intended to assess the relative importance of a common cause or factor by measuring the amount of agreement between its effects: it was used, for example, to measure the influence of inheritance in a physical characteristic, such as stature. Later, Galton was led to study the concomitant variation of a number of characteristics considered as a group. Thus, in discussing Bertillon's scheme of physical measurements for the identification of criminals, he pointed out that what was really needed was a set of traits showing as little intercorrelation as possible. Pearson carried this argument to its logical conclusion; and showed how the variations of a large number of intercorrelated characteristics might be described in terms of a small number of uncorrelated factors. Thus, in physical measurements, we find a "general factor" for size, accounting for the fact that growth in all directions is more or less proportionate, and a special or "bipolar factor" for body-build, accounting for the familiar classification of individual physique into the well-known leptomorphic and pachymorphic types (Kretschmer's asthenic and pyknic types).

The first psychologists to use correlational methods for the study of mental capacities were Galton's own pupil, McKen Cattell, and Cattell's younger colleague Wissler. They assumed that, with mental traits as with physical, both general and special factors would be found. Spearman, however, made the startling suggestion that all the intercorrelations between mental characteristics could be attributed to one general factor only. Although his view is no longer accepted, the eager controversies that

it aroused led to a vast number of factorial studies, mainly concerned with tests of intellectual abilities. Owing partly to the pressing needs of educational organization, and partly to the accessibility of children for mental testing, the greater part of this early pioneer work was carried out by educational psychologists, schoolteachers, and school medical officers, working in London schools. From a practical standpoint, the most important outcome was the demonstration of an innate, general, intellectual factor popularly known as "intelligence", and the development of standardized tests for the diagnosis of mental deficiency and for educational and vocational guidance generally.

The problems referred to the school psychologist, however, included not only cases of intellectual deficiency and special disabilities, but also cases of emotional or moral disorders—delinquency, psychoneurosis, and so-called moral deficiency. Here the problems of classification and causation were still more bewildering. Accordingly, as early as 1915, it was suggested that the factorial technique might be fruitfully applied to the investigation of the emotional aspects of human personality. Almost at once, a general factor of emotionality was clearly established, together with bipolar factors reminiscent of the old traditional temperaments. The former, it was suggested, indicated the element of truth contained in McDougall's notion of a "common fund of emotional energy" and Jung's later doctrine of *libido*. The latter provided a confirmation of Binet's distinction between "objective" and "subjective" types of personality, and the analogous distinctions between "extraverts" and "introverts" (or "cyclothymes" and "schizothymes") as suggested by Jung and Kretschmer. By 1923, factor analysis had provided a convenient working scheme for the study of what was called "personality",<sup>1</sup> which has been used freely in child-guidance clinics and elsewhere; and, what was even more important, the method made it possible to assess, with some approach to scientific accuracy, the relative importance of different contributory causes and of different diagnostic symptoms in various subnormal conditions.

During the last twenty years these statistical devices have been taken up with great enthusiasm in the USA under the lead of Kelly, Holzinger and Thurstone. The chief results are brought together by Dr. Raymond Cattell in his recent book, *The description and measurement of personality*.<sup>2</sup> The change in viewpoint will be seen at once on comparing this work with that of Gordon Allport on personality.<sup>3</sup> Allport's masterly review followed the

<sup>1</sup> Cf. C. Burt, Mental differences between individuals. *Rep. Brit. Ass.* 1923, p. 215.

<sup>2</sup> Raymond B. Cattell, *The description and measurement of personality*. New York, World Book Company, 1946; London, Harrap & Co.

<sup>3</sup> G. W. Allport, *Personality: a new psychological interpretation*. New York, 1937.

## CHEMOTHERAPY IN TYPHUS

*Continued from page 374*

numerous drugs tested in the laboratory for activity against typhus by Andrewes, King, van den Ende & Walker (1944).

Although the chemotherapeutic trials against typhus fever were not successful under the conditions in which they were carried out, the detailed clinical, biochemical, serological and pathological investigations made during the trials and reported in this monograph constitute a valuable record of louse-borne typhus as seen in North Africa and Naples in 1943 and 1944.

The laboratory studies on the immunology of typhus fever, made at the National Institute for Medical Research and at the Royal Army Medical College Emergency Vaccine Laboratory, are an important contribution to knowledge in this field.

## REFERENCE

Andrewes, C. H., King, H., van den Ende, M. & Walker, J. (1944) *Lancet*, 1, 777

impressionistic studies of Jung, Freud, and Stern, and appeared before the wave of statistical researches on human personality had fully reached America. In his own survey, Dr. Cattell enumerates about thirty different factors, all apparently well established in the sense that they have been found by at least three independent observers. Many of these, however, seem to be different names, or allied forms, of much the same thing; and he believes it possible to reduce the entire list to about twelve fundamental components. To a large extent these correspond with the factors already discovered in Britain. They include general ability (or intelligence), certain special intellectual abilities, general emotionality, and a number of temperamental factors. Most of them have definite implications for psychiatric work; and some seem primarily concerned with clinical or abnormal states. Of these the most important and the most conspicuous is that making for a cyclothymic or schizothymic temperament; others make for melancholia, hysteria, neurasthenia, paranoia, anxiety, and their respective opposites.

Dr. Cattell's list of factors, as he himself emphasizes, is provisional only. But it is evident that, if this procedure is applied rigorously and systematically to further trustworthy data, it will do much to solve the puzzling problems of the classification of nervous and mental disorders. The accounts that are now being issued of the results obtained by psychologists and psychiatrists, both in Britain and in the USA, suggest that in two or three points his conclusions will need revision. He has evidently overrated the validity of behaviour-ratings and personality-tests as compared with personal questionnaires; he tends to describe normal characteristics in terms of psychiatric concepts rather than vice versa; and he is apt to force as many factors as possible into bipolar form. These defects, however, are defects rather of the material available at the time of his investigation than of Dr. Cattell's own standpoint.

A recent book, *The dimensions of personality*\* by Dr.

Eysenck, carries the results still further. It records the results of more than three dozen separate researches carried out on several thousand normal and neurotic subjects. Most of the work was done at Mill Hill Emergency Hospital, and the majority of the patients were men and women referred from the Armed Forces. An important feature of the investigations has been the close collaboration between medically-qualified psychiatrists and a group of non-medical psychologists using such specialized techniques as standardized tests and factorial analysis.

The investigators "started from the position that measurement in the field of personality is impossible until the dimensions along which such measurement can take place are known." The field of survey has not been limited entirely to normal or abnormal traits of temperament, but covers bodily physique and constitution, intellectual ability and efficiency, aesthetic appreciation and expression, and problems of hypnosis and suggestibility. A separate chapter is devoted to each of these main topics. Much the same factors or dimensions are discovered as before; and the same "hierarchical view of the structure of personality" is in the main confirmed. In particular, the analysis of the data obtained from neurotic cases has fully corroborated two main factors—which (subject to certain reservations) are labelled "neuroticism" and "extraversion-introversion" (or "hysteria-dysthymia").

Dr. Eysenck and his colleagues have discussed, in the light of their evidence, the value of physical types, physiological symptoms, and personality-tests for the diagnosis of psychoneurotic and psychotic disorders, and for the discrimination of the main subclasses. They frankly admit that their conclusions are tentative and sometimes even negative. That is almost inevitable in view of the material available. But their results demonstrate two points beyond all question: first, the value of co-operative research on common problems approached simultaneously from the standpoints of the psychiatrist and the psychologist respectively, and second, the value of testing tentative hypotheses and current views by an adequate statistical technique.

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\* [For particulars see Book Reviews.]

# Annotations & News

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## SOME MEDICAL CONFERENCES

Among the medical conferences being held this summer we have received notice of the following:

*In London.* International Congress on Mental Health, Central Hall, Westminster; from August 11-21, 1948, under the presidency of Dr. J. R. Rees, C.B.E. The Congress will be in three main parts: (1) Child Psychiatry—Theme: Personality development with special reference to aggression (August 11-14, morning sessions); (2) Medical Psychotherapy—Theme: Guilt (August 11-14, afternoon sessions); (3) Mental Hygiene—Theme: Mental Health and World Citizenship (August 16-21). All enquiries should be addressed to The Congress Organizer, International Congress on Mental Health, 19 Manchester Street, London, W.1.

Under the auspices of the Commission Internationale Permanente pour la Médecine du Travail, the Ninth International Congress on Industrial Medicine—the first for 10 years—is being held at the Caxton Hall, London, S.W.1, from 13 to 17 September, 1948. The Congress will be in six sections dealing with Social Aspects, Environment, Nursing, Clinical, Practice, and Special Subjects. Visits to Rehabilitation Centres, Clinics, Hospitals, etc., during Congress week and the week following are being arranged. The address of the Organizing Secretary is Room 501, Garden Court Wing, BMA House, Tavistock Square, London, W.C.1.

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*At Salzburg,* the Austrian Medical Conference will be held on the 6, 7 and 8 September, 1948. The two main subjects of the Conference will be Blood Transfusion and Hypertension. Enquiries to the Sekretariat der oesterreichischen Aerztetagung, Salzburg, Landeskrankenhaus.

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*In Budapest,* in connexion with the centenary celebrations of the Hungarian War of Liberty, 1848, the Hungarian Medical Trade Union is arranging a Medical Week from 4 to 12 September, 1948. Detailed programmes will be sent, on request to the General Secretary, the Hungarian Medical Trade Union, Budapest V, Nádor Utca 32.

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*Les Entretiens de Bichat* 1948. In Paris the second annual series of informal discussions is to take place from the 10-17 October at the Hôpital Bichat. There will be two series of 100 discussions: (i) on surgery and various specialities (oto-rhinolaryngology, electro-radiology, gynaecology and obstetrics, ophthalmology, stomatology), from the 10-13 October, under the direction of Professor D. Petit-Dutaillis; (ii) on large questions of general modern medicine, from the 14-17 October, under Professors Guy Laroche and L. Justin Besançon.

The discussions are arranged in four series, each of 2 days, and are to be carried out with the help of 100 doctors from Paris hospitals, who are abreast of the latest clinical and therapeutic advances. Outlines of each subject will be supplied beforehand, and then discussed informally. Abstracts of all the introductory talks are to be published in September before the discussions by the Expansion Scientifique Française, 23 rue du Cherche-Midi, Paris.

Last year's colloquia, which were most successful, were attended by 842 french and foreign practitioners. Enrolments for 1948 can be sent to the Hôpital Bichat (Paris 18<sup>e</sup>).

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## FRENCH WAR-TIME RESEARCHES

It is difficult enough for those who did not actually experience nazi occupation to imagine how ordinary life was carried on,

under material and moral conditions which defy description. It is still more difficult to visualize the continuance of scientific research under such conditions. It was the resulting attitude of incredulity which struck Professor Pasteur Vallery-Radot on a post-war visit to America and gave him the idea of publishing a collection of articles which would be representative of the extensive and varied medical researches actually carried out in France during the war. This project, in which he enlisted the services of Professor Jean Hamhurger, of the Paris Faculty of Medicine, has resulted in an impressive volume entitled *Recherches médicales en France pendant la guerre (1939-1945)*, and containing 30 articles. Many of these had already been published, in journals or as part of a book, but several were written specially for this collection. The variety of subjects is wide, ranging from the purely clinical, as in the articles by Debré, Marie, Seringue & Mande, "Remarks on a neuro-oedema syndrome" (p. 7) and Gutmann, "Initial signs of gastric cancer" (p. 53), to details of chemical and bacteriological research, as in the articles by Nitti, Tabone & Mousset on "The antisliphonamide activity of peptone" (p. 245) and Lépine on "Studies on the determination, by means of ultracentrifugation, of the size of bacteriophages" (p. 39). The authors mentioned are but a few of the eminent authorities included among the contributors. Other examples are: Leriche, "Remarks based on 800 lumbar gangliectomies"; Lacassagne & Danyss, "Three notes on mammary cancer in mice" and two articles by Vallery-Radot and others on "Clinical and biological discussions of polycystic kidneys" and "Effect of sulphonamide therapy on the kidney".

The reader cannot help being impressed by this wide range of subjects and the wealth of detailed and careful investigation that has been carried out. The criticism that there is no evidence, in this haphazard collection of individual observations, of any planned research into particular fields, while true as an isolated statement, is surely one which ignores the conditions, described in Vallery-Radot's preface, under which the work was done, and which played such an important role in the genesis of the book. The expressed object of this volume is to show the outside world that, in spite of indifference, and even active opposition, from above, french scientific workers still "carried on" under the german occupation. In these circumstances, planned research would hardly have been possible, and the book aims merely at presenting representative samples of the work accomplished. A more valid argument would seem to be that the editors might well have arranged their material more systematically, grouping the articles by subject, even though the work described was actually done independently, instead of in an apparently arbitrary order. This would have been a great improvement from all points of view; it would have answered even more satisfactorily those sceptics who believed french scientific investigation to be at a standstill during the war, by showing at once how much had been done in each field; it would have facilitated reference; and lastly, it would have created a more orderly impression in an otherwise excellently produced book.

The physical composition of the book is of a high standard: paper and type are good; the half-tone illustrations (radiographs, etc.) leave something to be desired, but the tables and graphs are neat in appearance and, on the whole, clear. An attractive and useful feature is the brief summary at the beginning of each article, printed in italics and enclosed in a "box". Full bibliographies are appended to most articles, but it is a pity that no consistent style for references appears to have been used.

It would seem appropriate to say a special word on the subject of indexes. There is a list of contents in chronological (and therefore haphazard) order, but no index to this book. This exemplifies an all too frequent omission in french works, often, as in this case, lowering the generally high standard of production. In addition to a subject index, an alphabetical list of authors would be useful here.

In spite of these few criticisms, however, it seems to us, in the first place, an interesting and useful idea to publish a book of this kind and, in the second place, that the editors' aims have been, for the most part, fulfilled. The book cannot fail to impress its readers and will be a lasting tribute to the achievements of France in medical research under the occupation.

A. H.-S.

<sup>2</sup> [For particulars see *Book Reviews*.]



## ANTI-TUBERCULOSIS MEASURES IN SPAIN

Five books<sup>1</sup> issued during 1945, 1946 and 1947 by the *Patronato Nacional Antituberculoso*, which deal with tuberculosis control in Spain, have reached us. Two of these books are entitled *La lucha antituberculosa en España*, one being a book of 366 pages, published in 1945 and giving a detailed account of the activities of the *Patronato Nacional Antituberculoso* (PNA), its organization, administration and future plans. It includes statistical information on the results of investigations by PNA into the incidence of tuberculosis in Spain, and gives particulars of the services which have been set up to combat this disease. The second and smaller book was published in 1946 and gives a summary of the progress made by the PNA since its foundation in 1936 in the provision of services for tubercular patients. Many new sanatoria have been established and the number of beds available for tubercular patients has risen from 2,500 in 1936 to 11,000 in 1946. One of the preventive measures adopted by the PNA has been the establishment of settlements for children with a family history of tuberculosis. Both these books are illustrated with numerous photographs and tables.

The other three publications of the PNA deal with special aspects of the antituberculosis campaign. *La tuberculosis pulmonar inadvertida*, 1946, by Dr. Jose Zapatero stresses the importance of early x-ray diagnosis and gives details of radiological investigations carried out among various groups of the population such as soldiers, miners and students. Dr. Zapatero emphasizes the need for increased sanatorium accommodation. *Estudio de las contralateralizaciones, especialmente precoces, en los procesos pulmonares tuberculosos de apariencia radiológica unilateral*, 1946, by Dr. F. Tello-Valdivieso contains clinical histories of a number of his patients at the central antituberculosis dispensary in Zaragoza, and gives an account of their treatment and progress. The book is illustrated by numerous plates and includes a bibliography. *Estudios sobre el pulmón colapsado*, by Dr. Jose Abelló Pascual, 1947, reviews briefly the history of the treatment of pulmonary tuberculosis previous to the introduction of pneumothorax, and continues with sections on the macroscopic and histopathological anatomy of the collapsed lung, the mechanism of collapse and collapse therapy. Brief clinical histories are given in an appendix. The book is illustrated and contains a bibliography.

The PNA acknowledges that it has profited greatly from the experience of similar organizations in other countries. Its founders visited antituberculosis centres abroad, studied their organization and were grateful for the advice of their directors. Their hope is now that the work and publications of the PNA will be of use to colleagues in other countries and they invite visitors to come and see what has been accomplished in Spain and the work in progress there in the campaign against tuberculosis. When present plans are completed, 20,000 beds will be available for tubercular patients and Spain will have one tuberculosis dispensary for every 100,000 citizens.

V. E. C. M.

<sup>1</sup> [For particulars see *Book Reviews*.]

## THIRD INTERAMERICAN CONGRESS OF SURGERY

We have received three volumes<sup>1</sup> containing the texts of papers and addresses read at the Third Interamerican Congress of Surgery held in Montevideo in October 1946. The congress was organized by the *Asociación de congresos interamericanos de cirugía*, whose function it is to arrange surgical congresses at two-yearly intervals, to which affiliated societies may send delegates. Usually, three special subjects are chosen for the attention of the congress, and on this occasion these were: Complications and sequelae of surgery of the biliary tracts, Surgical treatment of cancer of the oesophagus, and The treatment of fractures of the pelvis. The texts of papers on these and on other subjects are included in these volumes. Bibliographies, indexes and a list of the statutes of the Association, make up a very complete and interesting account of the congress.

V. E. C. M.

<sup>1</sup> [For particulars see *Book Reviews*.]

## THREE IMPORTANT NEW BRITISH JOURNALS

Was it in a flash of prophetic wisdom that the Preacher cried out that of the making of many books there is no end? But how else should it be? As the field of knowledge and enquiry grows ever wider it becomes inevitable that it must be divided and subdivided; and natural that each subdivision, as it amasses new facts, should demand a vehicle for the publication and dissemination of its findings and techniques. Three subdivisions which in the last year have found it necessary to seek their own medium of expression are social medicine, nutrition, and plastic surgery. Of these the last-named is by far the youngest and most highly specialized, while the first to some extent includes the broader aspects of the second.

*British Journal of Social Medicine*. In turning first to social medicine, it may not be inappropriate to recall that just a hundred years ago, in a revolutionary Europe, the conception of medicine as a social science was taking shape. In Britain, Chadwick's classic Report on the sanitary condition of the labouring population had been published and created no small stir; in 1848 the first Public Health Act was passed. Now at last social medicine has its own journal; no. 1, vol. 1 appeared in January, 1947, and the first volume of four parts has been successfully completed. It is one of the group of attractively-produced journals published by the British Medical Association, and is edited by Professors F. A. E. Crew and Lancelot Hogben with the assistance of a distinguished editorial committee.

The editors have defined the scope of social medicine in the following terms:

As understood by those who are responsible for this Journal, social medicine is that branch of science which is concerned with: (a) biological needs, interactions, disabilities, and potentialities of human beings living in social aggregates; (b) numerical, structural, and functional changes of human populations in their biological and medical aspects. . . . Social medicine takes within its province the study of all environmental agencies, living and non-living, relevant to health and efficiency, also fertility and population genetics, norms and ranges of variation with respect to individual differences and, finally, investigations directed to the assessment of a regimen of positive health.

It will be seen then that the field is, in one respect, a wide one, making possible the inclusion of a great diversity of papers, but these will be confined for the most part to "work done", and it is expressly stated that the journal "is not meant to provide a platform for those who wish to present their views concerning the place of social medicine in the organizational set-up of medicine as a whole." The full contents of this interesting new journal are given in the Guide to the Journals in the present and previous numbers of this Bulletin and may be seen to range from "Dietaries in maternity hospitals" to "Studies on age and wastage in industrial populations", or "School medical inspections, their value and limitations."

The size of the journal is convenient and the format very pleasing; one small but useful point which we noted with pleasure was that at the top of each article is given its correct bibliographical reference.

*British Journal of Nutrition*. While, as has been seen, some of the wider problems of nutrition fall within the sphere of social medicine, others come in the purely medical or biochemical fields. But in practice, articles on one or another aspect of nutrition have been scattered in a wide variety of journals. In the attempt to cover most of the field the editors of *Nutrition Abstracts and Reviews*, for example, are obliged to scrutinize several hundreds of periodicals from the world literature of which not more than perhaps half a dozen are devoted solely or mainly to nutrition.

Nutrition in Britain as a science *per se*, then, has long felt the need for having its own journal and now, with the appearance of the *British Journal of Nutrition*, this gap has, in part at least, been filled. The first number of vol. 1 appeared in September, 1947, and the volume has recently been completed by the appearance of a double number (2-3). It is the intention, however, that future volumes should consist of four quarterly parts. The journal is published by the Cambridge University Press for the Nutrition Society of Great Britain, and is edited by an editorial board, composed of names all well known in the nutrition world, under the chairmanship of Dr. S. K. Kon of the National Institute for Research in Dairying.

The first part of each number consists of original articles. These have dealt with e.g.: vitamin studies, the composition and nutritive value of certain foodstuffs, the food requirements of various domestic animals, haemoglobin levels in pregnant

women, and metabolic studies in starvation and severe under-nutrition. The second part of the number contains the Proceedings of the Nutrition Society (both of the English and Scottish groups), formerly published separately but now incorporated in the journal. The subjects of the three conferences of the Society reported in this volume are of more than sectional interest, dealing as they do with "Education in nutrition"; the "Preservation, colouring and flavouring of foods"; and "British needs and resources of calories, protein and calcium." In addition short abstracts of papers communicated to ordinary scientific meetings of the Society are given. The journal is well produced and printed and we look forward to future issues with interest.

*British Journal of Plastic Surgery.* It is little more than a year since the formation of the British Association of Plastic Surgeons; now they have celebrated their first birthday by the production of a very handsome first number of the *British Journal of Plastic Surgery*, the official organ of the Association. Though a comparatively young branch of surgery, plastic surgery received a powerful impetus through the demands made on it by the crippling and disfiguring injuries sustained in two world wars and it has made rapid and daring progress, sometimes with strikingly dramatic results. But it is not only to the injuries of war that plastic surgery has brought relief and rehabilitation; the art has been applied to the often equally disabling consequences of industrial accident, of burns, and of congenital defects.

In this first number the opening article, by Sir Harold Gillies and Dr. R. J. Harrison, treats of a rare condition, congenital absence of the penis, and of the details of operative reconstruction—phalloplasty. The next article, of wider appeal, by Sir Archibald McIndoe, deals with deformities of the male urethra. In the third article, Mr. Rainsford Mowlem describes an operation involving the construction of a "lymphatic bridge" in the treatment of lymphoedema. Two articles, by Mr. J. B. Cuthbert and Mr. F. T. Moore, respectively, deal with the pollicization of the index finger after loss of the thumb; while in the last article Mr. M. C. Oldfield describes an operation for repair in the congenital condition of syndactyly.

The journal, which will not be confined to the field of a specialty but will include contributions from all allied branches of surgery and dentistry, has been launched with the blessings of the President of the Royal College of Surgeons of England and of a past President of the Royal College of Surgeons of Edinburgh. Professor Paterson Ross contributes a very interesting note on postgraduate surgical training, in which he discusses the relationship of the specialist surgeon to the general surgeon, and of the specialists to each other, and shows how they may derive mutual benefit.

The editor, Mr. A. B. Wallace of the Department of Surgery, Edinburgh University, and the publishers, Messrs. E. & S. Livingstone, are to be congratulated on this very fine production.

To these three new journals we venture to offer a welcome and to wish them a long and fruitful life. For surely Ecclesiastes was altogether too gloomy in thinking that much wisdom is much grief and he that increaseth knowledge increaseth sorrow.

1217

## BULLETIN OF THE WORLD HEALTH ORGANIZATION

We have received the first number of this long-awaited periodical, which replaces not only the *Bulletin of the Health Organisation* of the League of Nations but also the *Bulletin mensuel de l'Office international d'Hygiène publique*. For the present it is being published in only two editions, English and French, but it is hoped later to publish it in several other languages. It will contain communications submitted by representatives of the Member States during the sessions of the Assembly and of the Executive Council, official reports from the expert committees, and original articles by experts and specialists attached to WHO. As pointed out in the editorial, however, the new health organization has a wider scope than its forerunners and this may be expected to influence the final character of the *Bulletin*. This first number, in the nature of its contents as well as in format and general lay-out, closely resembles the old League of Nations publication. Nearly half the space is taken up by an article on tuberculosis in Greece illustrated by well-reproduced photographs. For the rest, there are reports from two expert committees, on biological standardization and on malaria; a series of notes on

the immunity reaction after vaccination and on post-vaccinal encephalitis (two of the urgent questions referred to the Interim Commission of the new organization by the Office international d'Hygiène publique); and articles on rodent infestation in ships, on relapsing fever, and on the anti-malaria campaign in Greece in 1946. The periodical is well printed on reasonably good-quality paper and shows evidence of careful editing. Bibliographical references, for instance, are uniform in style for the most part, the abbreviations of the titles of periodicals being appropriately enough, in accordance with the code drawn up by the International Institute of Intellectual Co-operation in 1930, a style now familiar to English readers through its use in the *World List of Scientific Periodicals* and in a large number of scientific periodicals published in this country and in America. There are however a few cases as, e.g. on p. 197, where authorities are quoted in the text without any reference being given, a practice that causes much annoyance and loss of time to anyone wishing to consult the originals. We wish the new *Bulletin* well and heartily share the editor's hope that it may become a medium for forging strong intellectual links between its readers in all countries.

Cyril C. Barnard

1218

## SURGICAL ANNALS

The *Annals of the Royal College of Surgeons of England*, which began publication in July 1947, has now completed its first volume. As explained by Sir Alfred Webb-Johnson, the President, in a Foreword, the new journal is designed to serve as a medium for the publication of lectures delivered at the College and will also include items of historical interest, accounts of recent events, and a diary of forthcoming functions, lectures and practical classes. The decision of the College to make the world conversant with recent advances in surgery and with the corporation's multifarious activities by the publication of its own journal will be widely welcomed. The journal is issued monthly and is edited by Sir Cecil Wakeley; format and general production are excellent. In the past the medical corporations of Great Britain have been responsible for the publication of many books, catalogues and reports, but, unlike the Colleges of Physicians and Surgeons of America, they have never issued their own journals over any considerable period. We cannot remember any British journal comparable in scope and purpose to the *Annals*, but honourable mention must be made of the *Medical Transactions* published by the Royal College of Physicians, in six volumes, between 1768 and 1820.

The first volume of the new journal contains lectures by Major-General Philip Mitchiner on gangrene and on surgery in two wars; by A. C. Lendrum on painful tumours of the skin; by R. W. Nevin on the surgical aspects of intestinal amoebiasis; by H. S. Souttar on recent advances in the treatment of carcinoma of the oesophagus; by V. E. Negus on injuries and cicatricial stenosis of the larynx; by Sir Lionel Whitby on blood transfusion and intravenous therapy; by Rainsford Mowlem on the replacement of skin losses in traumatic injuries; by E. Sprawson on foods and feeding as they affect teeth and their environment; by W. K. Livingston on physiological responses to wounding; by R. J. V. Pulvertaft on post-operative pulmonary embolism; by T. Cecil Gray on the use of d-tubocurarine chloride in anaesthesia; by M. Forrester-Brown on operative procedures in poliomyelitis; by J. R. Learmonth on the problems of portal hypertension; and by Sir Cecil Wakeley on vogue and fashion in abdominal surgery. There are contributions by three of the most distinguished American surgeons of the present day: Dr. Frank Lahey's Cecil Joll Lecture on hyperthyroidism; Dr. Arthur W. Allen's Moynihan Lecture on duodenal ulcer; and Dr. Evarts Graham's Lister Oration on some aspects of bronchiogenic carcinoma. Several articles and notes deal with the Royal College itself. Professor Willis writes on the Museum of Pathology and Mr. Le Fanu on the vicissitudes of the College Library during the war. On the historical side we note the Vicary Lectures of Sir Arthur MacNalty on the Renaissance and its influence on English medicine, surgery and public health and of Dr. E. Ashworth Underwood on naval medicine in the reigns of Elizabeth and James the First. Sir Arthur Keith breaks new ground in writing on John Hunter as a psychologist and Sir Heneage Ogilvie writes on a hundred years of gastric surgery. Interesting notes on

Hunter's bust in Leicester Square and on "Robin Adair," the romantic eighteenth century surgeon, appear over the initials of the distinguished President of the College.

W. J. B.

1219

## MEDICAL BOOKMAN AND HISTORIAN

*The Medical Bookman and Historian*, a monthly journal now in its second volume, commenced publication in January 1947, as the *Medical Bookman*. By November it had established itself and, under the direction of a distinguished editorial board, was renamed *The Medical Bookman and Historian*. In this form it represents the first english journal devoted to the cultural and historical aspects of medicine.

1220

## EXCERPTA MEDICA

This is a dutch enterprise with its central administration in Amsterdam, and a chief Editorial Board of three, headed by Prof. M. W. Woerdeman to direct the general medical side of the project. Vol. 1, no. 1 of most sections appeared in 1947 and a few are still awaited in 1948.

*Excerpta Medica* aims at providing a comprehensive abstracting service of world medical literature to replace such reliable journals as the *Zentralblätter* and *Berichte* of Julius Springer Verlag, Berlin, that have totally disappeared during the war years. Its service is claimed to be more comprehensive and wide-spread than any provided by earlier journals, and it is proposed to include abstracts of every article published in every available medical journal in the world. They will all appear in the english language and will be arranged in separate sectional journals as follows: Section I Anatomy, Anthropology, Embryology and Histology; Section II Physiology, Biochemistry and Pharmacology; Section III Endocrinology; Section IV Public Health and Social and Industrial Medicine; Section V General Pathology, Pathological Anatomy and Bacteriology; Section VI Internal Medicine; Section VII Pediatrics; Section VIII Neurology and Psychiatry; Section IX Surgery; Section X Obstetrics and Gynaecology; Section XI Oto-, Rhino-, Laryngology; Section XII Ophthalmology; Section XIII Dermatology and Venereology; Section XIV Radiology; Section XV Tuberculosis.

1221

## A NEW SPANISH ABSTRACTING AND INFORMATION SERVICE

*Boletín Noticiario Internacional Médico* (Madrid) is a new weekly journal designed to provide medical men in Spain with abstracts in Spanish of important articles originally published in other countries, especially the USA, Great Britain, France, Switzerland, Sweden, Italy and the Argentine. The editors undertake to obtain for readers a reprint of any complete article in its original language or in Spanish, and it is hoped to form a library containing works by specialists in Spain and elsewhere. It is hoped also to have a translation service, in connexion with the library, which would specialize in medical translations. Films from the USA will be shown from time to time. The first number (vol. 1, no. 1, February 1947) of this journal contains abstracts from various british and american journals.

1222

## A NEW MICROFILM SERVICE

In the first number of *Unesco Monitor* (August 1947, published from Unesco House, Paris), which contains mainly information about educational and cultural activities, the following note is inserted:—

A new microfilm service to spread knowledge on bacteriology and allied sciences has been put into operation by the Pasteur Institute of France.

The service is free of charge to all who require literature on research methods in bacteriology. Upon request, the Pasteur Institute will supply microfilms of any article in the reviews and journals available.

It is expected that the service will greatly assist the dissemination of information on the latest materials and techniques in that field of science.

1223

## AN ASSOCIATION OF MEDICAL LIBRARIANS

The need for an association of medical librarians which would correspond, for instance, to the Medical Library Association of America, has long been felt in Great Britain, the formation of such a body having actually been suggested by Sir William Osler, as long ago as 1909, at the annual meeting of the British Medical Association. This need has now been met by the formation of a medical subsection of the Library Association, under the chairmanship of Mr. C. C. Barnard, Librarian of the London School of Hygiene and Tropical Medicine; the inaugural meeting was held on 4 October 1947 and attended by librarians from medical institutions in all parts of the country. Membership is confined to members of the Library Association, but medical men and others interested will always be welcomed as guests at meetings.

The principal projects designed to increase the efficiency of the medical library service consist of: the compilation of a union list of medical periodicals, which will serve as a guide to the sets held in british libraries; inter-library loans; and an exchange system for duplicate and unwanted books and periodicals, which will help librarians to complete imperfect sets. A monthly bulletin is also being issued, both as a medium for the exchange of news and views and as a link between members separated by distance and unable to attend all the meetings.

In addition to these activities, regular meetings will be held, at which talks by medical men and others will be given, and papers on technical and bibliographical questions will be read and discussed; visits to places of professional interest will also be made.

The first meeting of this kind was held at the National Institute for Medical Research, Hampstead, and was well attended, both by librarians and the medical profession. The subsection was welcomed to the Institute by the Director, Dr. C. R. Harington, and the meeting was then addressed by Dr. George Popják, of the Biophysics Department of the Institute, who gave a very interesting talk on Elementary Biophysics; finally, Miss Wigmore, the librarian, outlined the history of the library and members and guests were shown its many interesting features. The success of this meeting, which owed much to the kind co-operation of the National Institute for Medical Research, augurs well for the future.

The secretary of the subsection, Mr. W. J. Bishop, of the Wellcome Historical Medical Library, 183 Euston Road, London, N.W.1, will gladly answer enquiries from librarians and members of the medical profession.

H. M. C.  
A. H.-S.

1224

## PUBLICATIONS AND REPORTS

From Argentina comes an interesting report of work done there for sufferers from leprosy and for their dependants. This report, entitled *Memoria correspondiente al ejercicio vencido el 30 de abril de 1944*, is published by the Patronato de Leprosos of Argentina and contains a comprehensive account of the work done during that year by the various committees and societies affiliated to the Patronato. Reports from the regional leper centres throughout the country are included, as well as a list of donations received, and an index. The report is illustrated with photographs of colonies under the control of the Patronato de Leprosos, and of the preventive colonies where children of leper parents are cared for.

The Instituto de Perfeccionamiento Médico-Quirúrgico, Buenos Aires, has sent us a copy of *Conferencias—1945*. This book contains the text of a number of lectures delivered during that year. The subjects dealt with include total gastrectomy in cancer

of the stomach (Professor I. Goni Moreno), conservative treatment for gangrene of the extremities (L. Feldman), observations on the clinical, radiological and surgical interpretation of disorders of dental origin of interest to the surgeon (R. A. Vivone), and a general review of homoeopathic treatment as applicable to surgical cases (A. N. Mazetti). The book is illustrated with photographs, tables and diagrams and an index is included.

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The Institut de Recherches sur le Cancer de Lille was founded in 1936 by a franco-american effort of co-operation, and is the only establishment in France devoted exclusively to research, as opposed to the clinical problems of diagnosis and treatment, on the subject of cancer.

We have received a report (*Institut de recherches sur le cancer de Lille*, Cité Hospitalière, Lille, 1946) issued by this institution, which describes its foundation, objects, general organization and methods of work in some detail. The work carried out at the Institute since its opening in 1939 is summarized in two sections: the annual reports of the director, and a bibliography of papers published by members of the staff. A section of photographs of the building and details of the administrative council and technical staff are also given.

1225

# JOURNALS NEWLY RECEIVED

*Notes on journals received for the first time, usually in exchange with the British Medical Bulletin*

*Jornada Médica* (Buenos Aires) is a new journal, of which vol. 1, no. 1 appeared in June 1947. It is published monthly and is designed principally for medical practitioners whose time for reading is limited but who wish to keep abreast of new developments in medicine. Both theoretical and clinical aspects of medicine will receive attention and the editors hope their journal will help to disseminate knowledge and thereby prove beneficial to patients. The first number contains four original articles, dealing with the clinical aspect and treatment of amoebiasis by Dr. Silvio Parodi, the construction and grafting of a finger by Dr. Francisco E. Arespacochaga, influenza and seasonal colds by Drs. Hernán Gonzalez and Carlos Floriani, and acute intestinal obstruction by Dr. Armando F. Giordano. A special section is devoted to translated extracts from the *Archives of Internal Medicine* and further sections contain abstracts from other journals and bibliographical comments.

The *Boletín Mensual* of the *Instituto Nacional de Previsión Social* (Buenos Aires) is a monthly journal which began publication in 1946. In the editorial of vol. 1, no. 1 (October 1946), the first number we received, the hope is expressed that this new journal will play a useful part in the investigation of social problems in Argentina, in finding a solution for them, and in awakening the public conscience to their existence. The Instituto Nacional carries out investigations and research into social questions and in this number of its journal publishes some of the results of its enquiries. The first article is contributed by members of the legal department of the Institute and examines the legal position of illegitimate children in Argentina. The text of resolutions and decrees made by the Institute is also included, with statistics relating to its finances.

The *Revista Médica de Rosario*, of which year 37, nos. 5 and 6, May and June 1947 have been received, is the official organ of the *Círculo Médico de Rosario*, Argentina. The May number contains four original articles and book-review and abstract sections. The June number contains six original articles, book-review and abstract sections and notes of meetings of medical societies in Rosario.

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From Australia come the *Clinical Reports of the Adelaide Children's Hospital*, vol. 1, no. 1, May 1947, the first attempt to publish details of the work of this hospital, at which, in 1947, 5,557 children were treated as in-patients, and 65,072 as out-patients. The *Clinical Reports* are to appear from time to time

and the Editorial Committee plans to publish the second number in November 1947. While the Committee realizes that papers in the journal must generally be based on continued medical practice, it hopes that they may contribute to the sum total of knowledge and to the wellbeing of the child. There are articles in this number on The treatment of influenzal meningitis, Leukaemia in children, and Acute osteomyelitis treated by penicillin. *Clinical Reports* should be a useful addition to the small number of paediatric journals in the english language.

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The first number of vol. 2 (January 1947) of *Klinische Medizin* was received from Vienna. This journal, sub-titled "austrian journal for scientific and clinical medicine", appears on the 1 and 15 of each month and is published by Urban & Schwarzenberg. The price per quarter is S.18, per single number S.4. All editorial communications should be directed to Prof. Dr. L. Arzt, Wien IX, Alserstrasse 4.

Among the original articles in this number are communications on the mechanism of aerophagy, infectious diseases in Austria in 1946, diagnosis and therapy of typhus, and the radiography of joints. A section of abstracts of articles in other journals is also included—in this number all from the *British Medical Journal*.

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Copies of two publications issued by the University of Minas Gerais have reached us. The first of these is the *Anais da Faculdade de Medicina* of the University (year 4, vol. 2, 1945), which consist of the texts of four lectures delivered by members of the Faculty of Medicine and six original articles. These lectures and articles deal with diverse subjects, which include a study of changes in the blood serum in 100 cases of leprosy (O. Versiani Caldeira & E. A. de Cerqueira), clinical notes of a patient suffering from cobra-bite (O. de Magalhães), and a study of the prophylactic and therapeutic properties of sulphadiazine, sulphapyridine and sulphanimide, especially in malaria (S. Americano Freire, C. Cristoff & W. Lobato Paraense).

The second of the publications is the *Anuario da Faculdade de Medicina* (year 5, vol. 3, 1946). This journal is composed of reprints of ten articles contributed to brazilian journals by members of the Faculty.

*Anais da Faculdade de Medicina do Recife*. This journal is the official organ of the faculty of medicine of Recife, Brazil, and no. 10-11 for years 10 and 11 (1943-1944), published in 1946, has been received. This number contains three articles, the first being a contribution to the study of yaws (J. Lôbo). The second article, on Manson's schistosomiasis, is the text of a lecture delivered at a medical congress in Recife by Dr. H. Menezes, and the third article deals with cutaneous amoebiasis (S. Campos). This number also contains a book-review section and statistics issued by the department of morbid anatomy.

*Arquivos de Clínica* (Rio de Janeiro) is now in its third year of publication and no. 3 of vol. 3 for September 1946 has been received. This number contains the second part of an article, the first part of which appeared in the previous number, on clinical haematology (Michel Jamra), an account of inflammatory lesions of granulomatous type seen in human visceral leishmaniasis (Luigi Boglioli) and a contribution on the treatment of liver disease (S. A. Portis). An account of some meetings of the Faculty of Medicine of Rio de Janeiro and news and abstract sections complete the contents.

*Arquivos da Faculdade Nacional de Medicina* is the official organ of the faculty of medicine of Brazil University and is published in Rio de Janeiro. It was founded in 1946, the first number being dated July 1946. The journal publishes original articles, and this number contains nine contributions which include the following: sclerosing bone sarcoma of the femur with clinical notes (Castro Araujo), the metabolism of iodine (A. Couceiro & E. De Robertis, and oligophrenia accompanied by multiple intercranial calcifications (J. L. Lopes).

*Brasil Médico-Cirúrgico* (Rio de Janeiro) year 8, no. 5-6, October-December 1946, contains four original articles dealing respectively with pulmonary embolism, by Drs. Egidio S. Mazzei, Taylor Gorostiaga & Elyescr Magalhães; sigmoiditis with

perforation, by Drs. Adolfo Dujovich & S. Form; gastroenterology, by Dr. Manoel F. Garcia; and the historical foundations for specialization in the field of internal medicine, by Dr. Pedro Nava. The section of notes for practitioners, which is a regular feature of this journal, gives in this number clinical details of some cases of diphtheria in children. In conclusion there is a list of journals received, and a news section.

Also from Brazil comes *Ginecologia* (Recife), which appears every two months, and which started publication in 1946. We have received no. 4 (August 1946), which contains three original articles, including a contribution from Dr. James Young dealing with the development of obstetrical studies in Great Britain, and some notes on medical folklore among primitive peoples by Dr. Ferreyra dos Santos. The journal also gives detailed accounts of the opening ceremonies of the new Universities of Bahia and Recife.

*Neuronio* is a quarterly bibliographical journal published in São Paulo, of which we have received vol. 8, no. 1, for the first quarter of 1947. This journal publishes in Portuguese abstracts from latin-american journals, and also from time to time original articles. The present number contains 26 pages chiefly devoted to abstracts arranged under subject headings, and there is a short news-section.

*Revista de Higiene e Saúde Pública* (Rio de Janeiro) is the official organ of the Sociedade Brasileira de Higiene. The number for April-June 1947 inaugurated a new series of the journal, then in its fifth year of publication. The editorial expresses the hope that the journal will play a useful part in the work for the betterment of world health. The number opens with a biographical note on Dr. Fred Lowe Soper, a member of the Sociedade Brasileira de Higiene, recently appointed director of the Pan-American Health Division in Washington. Other features are articles on the importance and geographical distribution of some of the mosquitoes found in Brazil, and on the diseases prevalent in the province of Alagoas. News and abstract-sections are also included.

We have received for the first time a copy of *Revista Médica Municipal* (Rio de Janeiro) a periodical which is published quarterly and is the official organ of the Public Health authorities. This issue, no. 1 of vol. 8, contains five original articles, which include a contribution from Dr. Joaquim de Brito on the treatment of stomach wounds from various causes, a review by Dr. Leão de Aquino of some outstanding events in the history of the Hospital Sanitário São Sebastião, with the text of addresses and articles published at various times in connexion with these events, and an article by Dr. Herminio Linhares on meningo-encephalitis in rats caused by a filtrable virus. Sections containing news, book reviews, abstracts from foreign journals, lists of journals received and their contents complete the number.

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*S'vremenna Pediatriya* (Contemporary Pediatrics) (Sofia), year 1, vol. 1, no. 7-8, 1947 is largely devoted to full abstracts of papers in world medical journals, on paediatrics and related subjects. The first article is an abbreviated version in Bulgarian of a paper on scabies by Gordon & Unsworth (*Brit. med. Bull.* 1945, 3, 209, BMB 776).

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*Archivos de la Sociedad de Cirujanos de Hospital* (Santiago de Chile) is a quarterly journal for surgeons of which we have recently received no. 2 of vol. 16, which appeared in June 1946. This number is divided into four sections, the first of which contains fifteen original articles. Among these are articles dealing with emergency treatment for gastro-duodenal ulcer by Dr. Marcial Baeza, melorheostosis by Dr. Orlando Poblete Nuñez, anal fissure by Dr. A. Schwartz, and acute torsion of the great omentum by Dr. Adolfo Dujovich. Most of the articles contain clinical histories of patients treated by the authors, with details of the response to the treatment given. The second section gives particulars of lectures and conferences of special interest to readers of the *Archivos*, and the remaining sections contain abstracts, notices and news.

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*Repertorio de Medicina y Cirugía* (Bogotá) was founded in 1909 to assist in the dissemination of medical knowledge in Colombia. No. 5 of vol. 2, July 1947, contains five original articles (on rabies, cancer of the gravid uterus, two surgical conditions, and menstrual epilepsy) and the first of a series of lectures on anaesthesia. Summaries in Spanish, and in some cases a bibliography, are given at the end of each article.

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Among the journals from Czechoslovakia reaching us for the first time is the *Bratislavské Lekárske Listy*, the journal of the Slovak University Medical Faculty and of the Slovak Medical Association, vol. 26, no. 9, September 1946. An effort is made to obviate the barrier raised by the use of the slovak language by giving lengthy summaries in Russian, English, French and German. In the english summaries, the translation is very literal, the spelling is sometimes phonetic, and there are many printer's errors; however, through these obscurities the general meaning of the articles appears, and the purpose of the summaries is achieved.

There are original articles on: complications of wounds of the cranium, Raynaud's disease, myocardial infarction in youth, surgical therapy and roentgenotherapy of struma, treatment of lip cancer.

We have also received vol. 47, no. 8 (1947) of *Ceskoslovenska Stomatologie*. Although it is an attractively produced journal on good paper, printed in clear type, it does not look for readers outside Czechoslovakia, as no summaries are given in other languages to guide the western european reader to its contents. What is more useful from the czech standpoint is the inclusion of comprehensive abstracts from world literature on dental subjects.

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*Anales* (Quito) is the official organ of the Universidad Central de Ecuador, which was founded in 1651. No. 322 of vol. 73 (January-December 1945) contains some very interesting features. There are sections dealing with medicine, history, education and literature. The medical section contains the text of a lecture on cancerology delivered by Dr. César Ricardo Descalzi at the Hospital Civil de San Juan de Dios, and a detailed study of three cases of erythroblastosis by Professor César Jacome. Professor Gonzalo Rubio Orbe contributes an interesting study of the Ecuador Indians, and also included in this number are some chapters of a work on the history of Ecuador in ancient and modern times which are being published in serial form, by Dr. C. Reginald Enock, F.R.G.S. The section of University news gives a summary of the chief events of the academic year 1945-46.

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*Le Progrès Médical* (Paris) is a well-known weekly of high standing, now provisionally appearing twice monthly, under the editorship of Professor Maurice Loeper and Dr. Maurice Genty. Apart from original articles and reports of lectures, it contains brief accounts of society meetings, abstracts of articles from both french and foreign journals, a section on the history of medicine, and a notes-and-news section. The subjects of the original articles in the number for 24 June 1947 (year 75, no. 12) are: Neptal and hypertonic subtosan (M. Perrault & P. Rousseau); Incomplete physiological section of the spinal cord (J.-A. Chavany); An attempt to find a biochemical test of the activity of massive rectal doses of vitamin D<sub>2</sub> (J. Desbordes & G. Feuillet). A report of a lecture by J. Boureau on Analgesia and anaesthesia in obstetrics is also given, and a further interesting feature is an article by G. Barraud, in the historical section, on roman medicine.

*Le Journal de Physique et le Radium* (Paris), of which we have received the number for February 1947 (series 8, vol. 8, no. 2), is published by the Société française de Physique. The main part of the journal is devoted to original articles, of obviously high scientific standard, on subjects connected with physics and radium; the majority of these are preceded by brief summaries. There is also a section of abstracts of articles from french and foreign chemical and physical journals, arranged under subject-headings; and finally a section containing reports of meetings of the Société française de Physique. The two last-named sections each have their own pagination followed by appropriate symbols. The typographical format is clear and of a standard



worthy of the subject-matter of the journal, while it is noteworthy that importance is obviously given to matters of style in such items as bibliographies and headings of abstracts.

Another french journal which we have received is *Monde et Médecine* (Paris), edited by J.-R. Frugier, with the assistance of a distinguished editorial committee, and published by Les Editions Universelles. Its sub-title describes it as an international review of the medical sciences, and the two numbers we have seen (no. 10, October–November 1946, and no. 11, December 1946–January 1947) consist entirely of original articles, mostly clinical, though some are of a more general nature, such as a report on the commemoration of the fiftieth anniversary of Pasteur's death, and an article on the effects of the atomic explosion at Hiroshima.

*La Revue Générale de Médecine et de Chirurgie de l'Union Française* (Algiers), now appearing once a month instead of three times a month as in pre-war days, is issued by the Société d'Expansion Médicale et Pharmaceutique. It publishes review articles, sometimes original, sometimes reproduced from french or foreign journals, on subjects of particular interest to the general practitioner in the french colonies. It also includes a bibliography section. The number for March 1947 (year 24, no. 494) consists of 14 articles, all reproduced from french journals, and the bibliography section, containing reviews of some half-dozen books.

After six years of interruption, due to enemy occupation and postwar difficulties, we welcome the re-appearance from Athens of the *Archives of Hygiene* (third period, 5th year, January–March 1947, nos. 1–3). The journal is an impressive royal quarto production, printed in clear type on beautifully crisp paper, and well illustrated with large charts. Conditions of health in Greece during the war, the enemy occupation and postwar years are reviewed by the Director-General of Hygiene; there is a synopsis of epidemics in Europe, an account of the achievements of UNRRA as an international health organization, and of the creation of the World Health Organization to which Greece looks with other nations for aid, in the rehabilitation of the people's health. "On the occasion of the re-edition of the *Archives of Hygiene*" the editor states the journal's aim is "to give an historic and real picture" of the task of rehabilitation of the greek people and to put greek scientists in contact with the new methods and inventions of the war years so that they may be properly introduced into Greece.

One of the most attractive of the new journals to reach us from Europe is the monthly international journal of paediatrics, *Paediatrica Danubiana*, published in Budapest. Articles are published in English, Hungarian, Russian, French or German, together with summaries in all five languages. The journal is well printed and illustrated, and its pocket-size (20 × 15 cm.) convenient to handle.

In the foreword to the first number, the editor-in-chief, Professor P. Kiss, states the aim of the journal to be the endeavour "to broadcast the results of the research of doctors throughout the world who are striving to improve the health and happiness of children." The names of a large number (40 in vol. 2, no. 6) of editors from all over the world appear on the title-page.

The first number, which appeared in January, 1947, contained articles on renal diabetes accompanied by rickets, by R. Debré, Paris; on primary atelectasis and birth trauma, by A. Eckstein, Ankara; on a method for the radiographical diagnosis of ear diseases in infants, by C. Gefferth, Budapest; on the effect of penicillin after antrotomy in infants and children, by E. György, Budapest. In each number is a short section containing abstracts of articles on paediatrics, from journals of various countries; for example, in the first number, from the *British Medical Journal* and from the *British Medical Bulletin*.

Manuscripts and correspondence should be sent to the Editor, Bókay János-utca 53, Budapest VIII, Hungary. The annual subscription is 22 hungarian florins, or \$9.

We have received vol. 1, no. 1 of the *Indian Journal of Malarology*, March 1947. Since papers published in this excellent journal may be contributed from sources other than the Malaria Institute, this more general title has been chosen to

replace the earlier *Journal of the Malaria Institute of India*. The latter had in 1938 succeeded the *Records of the Malaria Survey of India*. In vol. 1, no. 1 of the *Journal of the Malaria Institute of India*, the Director, Major-General Sir Gordon Covell, gave the history of the activities of the Malaria Survey of India from 1927–37. In the first number of its successor, he gives an account of the valuable work of the Malaria Institute of India from 1938–47.

Most of the contributions to this number are on malaria control, the de-weeding of tanks and ponds, the uses of insecticides with special reference to DDT; there is one clinical paper on certain aspects of paludrine.

Most interesting and useful bibliographical features are (a) the list of contents, arranged by volume and number, of the *Records of the Malaria Survey of India* and the *Journal of the Malaria Institute of India*, and (b) a classified list of publications from the beginning of the Malaria Survey of India in 1927, which forms Appendix III to the history of the Malaria Institute of India.

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*Rassegna di Neuropsichiatria* is the official organ of the Ospedale Psichiatrico Consortile di Nocera Inferiore, Salerno. This hospital was founded in 1883 and two years later began publication of a journal called *Il Manicomio* which was later replaced by *Archivio Generale di Neurologia, Psichiatria e Psicoanalisi*. The latter ceased publication during the war years and the *Rassegna di Neuropsichiatria* now takes its place. We have received for review vol. 1, nos. 1–2 of this new journal. The first article is by Professor Carmelo Ventra and gives an account of the Ospedale Psichiatrico during the years 1940–46. The area surrounding the hospital was heavily bombed and it suffered much damage, while problems of feeding and hygiene within the hospital became very difficult. The mortality rate began to rise in 1941, reaching its maximum in 1944, but since then has steadily declined. This number contains six further original articles, including one by Dr. L. Bini, of the Clinica delle Malattie Nervose e Mentali of Rome University, on the use of shock therapy in some unusual cases of psychosis. Clinical histories of cases treated are given. Dr. Domenico Rossi contributes an article on the psychopathology of chorea minor, and Dr. Giannetto Cerquetelli gives an account of his results in the treatment of multiple sclerosis with histamine. The journal also contains book review and news sections.

*Annali d'Igiene* is a journal published at two-monthly intervals under the auspices of the Istituto d'Igiene of Rome University. The first number to reach us is no. 1, of the 57th year, January–February 1947, which contains five main contributions. These include articles on exanthematous typhus during the italian expeditionary force's campaign in Russia (A. Spezzaferrì), some enzymatic properties of penicillin (F. Mulé) and an investigation into the question of whether an ultravirus may cause whooping cough (M. Carpano). This number also contains abstract and news sections.

Another journal from Rome is the *Giornale di Medicina Militare*, published under the auspices of the Direzione Generale di Sanità Militare, and now in its 94th year of publication. No. 5 for September–October 1947 contains articles on physical work and emotion in the pathogenesis of "soldier's heart" (G. Donati), peritonitis following perforation of the small intestine in typhoid (E. Zaffiro), and an account of gangrenous lung abscess with empyema cured by penicillin (P. Scaduto & A. Cimino). Also included are abstract and news sections.

Published in Naples, *Archivio di Tisiologia* appears at two-monthly intervals, and no. 4 of vol. 2, 1947 contains approximately 172 pages. The journal is divided into two distinct sections with separate paginations, the first being devoted to topics of general medical interest, and the second containing main articles on tuberculosis and allied subjects. The former section in this number contains accounts of three congresses held in Britain on tuberculosis and public health. The first of these articles, which is accompanied by an english translation, is an account of the Edinburgh Congress of 16–19 July 1947, to which the author was invited. He records his impressions of the Congress, and also of his subsequent visits to sanatoria and health centres in Britain. British clinical methods and operative techniques are compared with italian procedure.

*Tumori* (Milan), the official organ of the Istituto Nazionale per lo Studio e la Cura dei Tumori, is published at two-monthly intervals and is now in its 34th year. We have received no. 1-2 of vol. 21, series 2 1947, which contains eight original contributions. The first article of this number reviews the activities of the Institute since its foundation in 1928. Mention is made of much-appreciated gifts of books to the library from the USA, Britain and France, of the inauguration of a committee whose members visit the sick poor in their homes, and of the work of the various departments of the Institute. There are seven other original articles and an abstract section.

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*Sugestiones* (Mexico) contains some interesting features. In the number for June 1947 (year 11, no. 142) is a transcription of some pages from the book by Professor Alejandro A. Bogomolets on the prolongation of life. This particular passage discusses the question of what might be considered a normal life-span and gives a number of instances of continued human activity to an advanced age. An article on leprosy in Monterrey is contributed by Dr. A. Peyri who was formerly in charge of the leper island of Providencia. He gives details of treatments given to some of his patients and of the results obtained. Dr. J. López Durán writes on sex hormones, and there are also articles on the treatment of anaemia by Dr. J. G. Isabet, the use of vitamin D in the treatment of some skin diseases by Dr. José F. Brun, complete arrhythmia and mitral stenosis by Dr. Jorge Meneses Hoyos, a study by Dr. Pavón Serrelangue of a case of partial control of the autonomic nervous system, the diagnosis and treatment of deep wounds of the praecordium by Dr. Joaquín Maass Patiño, and the problem of malnutrition by Dr. Ramón Osorio y Carvajal. The journal also contains a section of bibliographical notes, a list of new books, and an article by Dr. Fausto Zerón Medina, in the *Artistas Médicos* section, on the doctor-poet Gabriel Guerrero Ibarra.

Also from Mexico comes *Química y Farmacia* (vol. 12, no. 109, Jan. 1947), the official organ of the Colegio de Química de México, and the number under review is the first to reach us. The editorial of this number emphasizes the need for co-operation between all peoples in order to further human progress. The contents include an article on the determination of the carotene, fat and protein content in maize; Part VI of a study of alchemy, medicine, pharmacy and pharmacopoeias from the 16th to the 20th centuries; biographical notes on Leopoldo Río de la Loza, a chemist, and Andrés del Río, a mineralogist; and a study of popular nutrition in Mexico, which stresses the advisability of increasing the cultivation of maize.

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The *Boletín del Ateneo Médico de Lima* publishes original articles on medical subjects with clinical histories of interesting cases, and also has a section containing abstracts from journals published in Spanish. The first three numbers of this journal to reach us were: vol. 2, nos. 1, 2, 3 (January-June 1947).

Another peruvian journal is the *Boletín de la Sociedad Química del Perú* (Lima, vol. 12, no. 4, December 1947). This number contains articles and the first instalment of the memoirs of Fernando C. Fuchs Carrera. Señor Fuchs Carrera has been connected with mining in Peru for fifty years and his memoirs are to be continued in serial form in subsequent numbers. Notes of the Sociedad Química and a list of publications received are also included.

*La Protección Materno-infantil en los Últimos Cinco Años*, Lima, is a report for the years 1940-1944, published by the peruvian Ministry of Health on its work on behalf of mothers and children. During the period reviewed the number of prenatal clinics and dispensaries for mothers and children was increased, and home-nursing facilities improved. It is noted that during these years there has been an encouraging decrease in infant mortality. The report gives an account of the present organization of the maternity and child-welfare services in Peru, and there is an appendix summarizing the principal resolutions and decrees in operation for the protection of mothers and children.

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The first number of the fortnightly journal, *Nowiny Lekarskie Dwutygodnik Społeczno-Naukowy*, to reach us from Poland is vol. 54, no. 21, 1947. The two main contributions are: a paper by Tomaszewski on vitamin A in health and disease, reviewing the subject and giving the results of his own research, as published in various polish journals and in the *Edinburgh Medical Journal*; and an account of two cases of polyradiculoneuritis by Jasiński. There are also items of polish medical news and a reproduction of the British Council Monthly Lists of new british medical publications for July and August 1947.

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*Revista de Psicología General y Aplicada* (Madrid) has been founded in order to form a link between all those who are interested in psychological problems, and as a medium for the exchange of information. The journal is published quarterly and each number will contain, in addition to original articles of psychological interest, information about new publications of interest to specialists in psychology. It has also been arranged to publish in each number a translation of an article from the *Psychological Review*, the organ of the American Psychological Association. From time to time an entire number will be devoted to some current psychological problem.

The first number (vol. 1, no. 1, 1946) of this journal contains 316 pages and six original articles, and also sections containing notes on laboratory tests and apparatus, bibliographical notes, reviews and news.

*Archivos de Enfermedades del Corazón y Vasos* (Barcelona) was founded in 1922 and is the organ of the Instituto de Medicina Práctica. The February-March number of vol. 30 (1947) contains three original articles, the first being a study of the arterial pulse and its dichrotic waves by Professor M. Bañuelos, of the Faculty of Medicine, Valladolid. Dr. Domingo de G. Durán Arrom contributes an article on certain diseases, such as rheumatism, arterial hypertension and cardiovascular syphilis, which damage the circulatory system. Dr. Arrom also contributes a section of clinical notes on cardiological practice. This number contains in addition a section of aphorisms, a therapeutic index, a news section containing abstracts from other journals and a bibliographical section.

*Galicia-clínica* (Corunna), is a monthly journal which publishes articles, news and book reviews of medical interest. No. 1, year 19, January 1947, contains 68 pages, and includes articles dealing with the treatment of burns (E. Sáenz Figueiras), the treatment of osteomyelitis (A. J. Echeverri), haemocultures and agglutination reactions and the interpretation of results (F. Beato), the extraction of foreign bodies from the oesophagus (Ortega). The news and book-review section gives information about appointments, events and new publications in Spain of medical interest.

*Odontoiatria* (Madrid) is described as an ibero-american journal devoted to the study of the mouth, its disorders and treatment. No. 23 of vol. 2, November 1945, the first to be received by us, contains four articles which include contributions on vitamin C in relation to gingivitis (J. S. Restarck & M. Pijoan), dental affections commonly found in air-crews (S. Forteza), and the psychological study of the patient (B. Martínez-Gil de Bretón). In addition, this number contains an editorial, book reviews printed on perforated pages to facilitate their easy removal for filing, and an abstract section.

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During 1947, we received vol. 21, nos. 1-3 of the *Quarterly Bulletin of Northwestern University Medical School* (Chicago). This beautifully-produced journal is printed in clear type on fine paper, and it has many good charts and illustrations. It is divided into two main sections, scientific and general; in addition there are an editorial, news of the Medical School, and a list of recent publications of the Medical School Faculty. Among the more interesting of the scientific papers are a series on work at high altitude, by Friedemann, Ivy and collaborators; and recent advances in hepatic and biliary disease, by Snell, with references to recent work.

The section General Contributions, includes historical and bibliographical studies, one, for example, by Laufmann on surgical haemostasis through the ages; and also papers recording the professional experiences of members of the Medical School in Italy and India.

The *Journal of the American Medical Women's Association* is another American journal linked to a medical institution, the New York Infirmary. This number (vol. 2, no. 3, 1947) has been contributed by the staff of the Infirmary; the scientific section includes articles on intra-uterine irradiation, the Rh factor in obstetrics, child guidance, a symposium on recent advances in therapy, and case reports.

The feature papers describe the history of the Infirmary, its traditions and present needs. It is well produced and documented, and includes a specially interesting feature in the list of current publications by women in medicine and in allied fields.

The following journals have also been received:

*Better Health* (London), vol. 20, no. 12, 1947

*Boletín de la Asociación Odontológica Argentina* (Buenos Aires), year 17, no. 199, 1947

*Bulletin of the Independent Biological Laboratories* (Kefar-Malal, Palestine), vol. 5, no. 3, 1947

*Chinese Journal of Nutrition* (Anshun, Kweichow), vol. 1, no. 1, 1946

*Hellinikiatriki* (Thessaloniki), year 17, no. 1, 1948  
*Medisiinari Lääketieteen kandidaattiseurau Julkaisu* (Helsinki) no. 3, 1947

*Népegészségügy* (Budapest), vol. 4, no. 1-2, 1948

*Oto-Noro Oftalmoloji* (Istanbul), vol. 1, no. 1, 1946

*Revista Stiintelor Medicale* (Bucharest), vol. 37, no. 1-2, 1948

*Salud* (Mexico D. F.), vol. 4, no. 4, 1947

*Türk Dişabipleri Cemiyeti Mecmuası* (Istanbul), vol. 24, no. 131-132-133, 1947

*Výživa Lidu* (Prague), vol. 2, no. 11, 1947

*Yaşamak Yolu Dergisi* (Istanbul), no. 131-133. [1946]

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## A MEDICAL PUBLISHER

Messrs. E. & S. Livingstone of Edinburgh, the well-known medical and scientific publishers, inform us that they have now opened a London office at 45 Lincoln's Inn Fields, London, W.C.2, where medical men desirous of inspecting the firm's publications are assured of a warm welcome.

# Historical Notes

1227

## PIERRE JANET (1859-1947)

The emergence of scientific psychology in the second half of the nineteenth century constituted a kind of intellectual epic. With this movement the name of Pierre Janet is indissolubly associated and due tribute is paid to this great French psychologist in *La Presse Médicale* for 23 August, 1947 (55, 561-562).

Pierre Janet was born in Paris on 30 May, 1859, and, after obtaining his "agrégation" in philosophy at the age of 23, taught for seven years at Le Havre. At the same time he worked at the municipal hospital where he was put in charge of a ward of neurotic cases; here he began his researches on hypnotism and the lower forms of mental activity, which formed the subject of his philosophy thesis, *L'automatisme psychologique*. This revolutionary attempt to apply hypnotism to psychology raised a storm on its presentation at the Sorbonne on 21 June, 1889. Soon after, he obtained a Paris appointment, and continued to lecture on philosophy while completing his studies in medicine and taking his doctor's degree. He then became head of the psychological laboratory at the Salpêtrière, where he worked first under Charcot and later under Raymond. In 1895 he began deputizing for Ribot as professor of experimental and comparative psychology and was officially appointed to the Chair in 1902. He occupied this position until 1934.

Janet's teaching was based on his minute observation of cases. He always took detailed notes of everything said by the patient and of every reaction, and classified his voluminous case-records like a hotanical collection, habitually referring to them as his "herhier". Most of his lectures were collected into book form and constitute the basis of his published works; some of the more important of these are: *L'état mental des hystériques* (1893), *Les obsessions et la psychasthénie* (1903), *Les médications psychologiques* (1919), *La médecine psychologique* (1923) and *De l'angoisse à l'extase* (1926-28). His teaching acquired a great reputation abroad, particularly in North America, where his influence was comparable only to that of Georges Dumas in South America.

The ruling idea throughout Janet's work—to establish a hierarchy of mental function based on *pathological psychology*—shows the influence of Ribot, with whom Janet came into contact early in his career. Ribot had been one of the first to apply scientific methods to psychology and, in particular, to obtain data valid for both disease and health from the analysis of mental disturbances, and it was this method which Janet adopted as the basis of his work. He maintained that there are two distinct forms of mental function: *automatic* or *conservative activity*, limited to reproducing the past, and *synthetic activity* which combines existing phenomena into new phenomena quite different

from their component parts. The first activity is repetitive and the second creative. Normal thought is composed of both forms, but in weakened psychological conditions the synthetic activity gives way to the automatic.

Janet was a doctor as well as a psychologist. His name is linked with the syndrome of psychasthenia, which he was the first to differentiate and describe. His *La médecine psychologique* summarizes his experience as a psychotherapist. In this field he surpassed all his predecessors in the use of hypnosis and was at the same time one of the forerunners of the psychoanalysts. He made important observations on the cure of hysterical hypermnesia which led up to the psychoanalytic conception of "transforming the unconscious into the conscious", but left it to Breuer and Freud actually to cross the threshold.

Janet found a source of satisfaction in his old age in following the rapid development of psychiatry; he lived to see many of his early ideas, which had been fiercely contested at the time, confirmed by modern methods of psychotherapy.

A. H.-S.

1228

## WAYFARERS IN MEDICINE

The pathways of the medical pioneers, if not always smooth at the time of their first explorations, are easy and pleasant for those who follow by the comfortable process of imaginative reading. Our guide, on the occasion under review, is a well known Dublin surgeon, and editor of the *Irish Journal of Medical Science*, Mr. William Doolin. He is familiar with the ground, and the wayfarers are all old friends of his. Although each of the twenty-six essays is complete in itself, the book preserves a chronological order, so that we pass from Imhotep to Sir Robert Jones, with such pleasant companions as Vesalius and Montaigne and Descartes and the less known Georges Mareschal, surgeon to Louis XIV. We accompany Amroise Paré on some of his "Journeys in Divers Places", we travel with Laënnec between Paris and his beloved Brittany, and we follow the career of General Gorgas who, by his war on yellow fever, made it possible for engineers to complete the Panama Canal and thus to facilitate still wider means of voyaging and wayfaring. Nevertheless this book is not a mere tissue of biographies, as a glance at the chapter titles will reveal.

The chapter on "Medicine and the Trade Routes" shows how the healing art followed the Moslem Empire in its westward march, and among other topics of interest, from which it is hard to make a selection, are "The Anatomist in Art", "The Resurrection Men", and "A Patient of the Renaissance", the last-mentioned being none other than Benvenuto Cellini, appearing in a guise which may be new to some readers. One of the most interesting chapters is that which deals with the history of lithotomy and, in particular, with Mr. Pepys and a number of other

<sup>1</sup> [For particulars see Book Reviews.]

writers who have recorded their trying experiences as subjects of "the stone". In the 16th and 17th centuries it was not uncommon to spread the news of a successful, or unsuccessful, operation by a broadsheet, or "Flugblatt", as it was termed in Germany, the home of such publications. The leaflet was often illustrated by a copperplate engraving of the stone. Its weight and measurement were also given, so that we have exact pathological records of the malady, which was then so common. The illustrations of this chapter, eight in number, are perhaps the most interesting in the book, although in general the reproductions are poor, being too small and indistinct to be of real value. Nevertheless the book is so attractively written that even without the plates it would have been most pleasing. It is sure to draw many readers, and it will amply prove that in medicine a study of the past is a most useful background to the practice of the present.

Douglas Guthrie

1229

## THE CHAMBERLENS AND THE MIDWIFERY FORCEPS

The story of the Chamberlens and of the invention of the midwifery forceps has often been told, but it is so remarkable that Dr. Radcliffe's little book<sup>1</sup> is sure of a warm welcome from all students of medical history and, indeed, from many members of the general public who will appreciate a new account of a most intriguing episode in history. So far as the Chamberlens are concerned, this book adds little, if anything, to the information provided by J. H. Aveling's book of 1882 or by such standard works as those of Herbert Spencer and Kedarnath Das; but Dr. Radcliffe gives an extremely good account of the later development of the obstetric forceps, with special reference to the contributions of three Essex surgeons—Edmund Chapman, William Gifford, and Benjamin Pugh. The work of Smellie, John Aitken, and John Burton ("Dr. Slop" of *Tristram Shandy*) and of the French and German pioneers is also dealt with, and altogether the book provides a most concise yet readable summary of the evolution of modern instrumental midwifery. The tangled personal history of the Chamberlens, beginning with Dr. William, the founder of the dynasty, who came to England as a Huguenot refugee in 1569, is here clarified. It is probable that William's son, Peter Chamberlen I (died 1631), was the inventor of the instrument that has preserved the family name. Hugh Chamberlen, Senior, was the chief exploiter of the secret and, by virtue of his position as accoucheur at the Court and by his contacts abroad, did most to spread the use of the forceps. The forceps themselves were lost to the world for more than a hundred years prior to 1813, when four sets were discovered in a box hidden under a floorboard at Woodham Mortimer Hall, near Maldon in Essex. This house was occupied by Dr. Peter Chamberlen III in the time of King Charles II, and it appears that the instruments were hidden by his widow. The secrecy which the Chamberlens maintained in regard to the nature of their invention has been strongly condemned, and poetic justice has led some historians to attribute the invention to other obstetricians. Strong claims have been made on behalf of John Palfyn, a surgeon of Ghent; but it is known that Palfyn visited London and it is probable, as Dr. Radcliffe maintains, that he heard of the forceps through one of the Chamberlen family and devised similar instruments of his own on his return to the Low Countries. Dr. Radcliffe also gives a graphic account of Hugh Chamberlen's visit to the Hôtel Dieu at Paris and of his unsuccessful attempt to deliver one of the great Mauriceau's patients—a rachitic cripple—by means of his forceps. He also deals with Chamberlen's later days at Amsterdam, where he is said to have sold the family secret to certain Dutch surgeons.

One or two slight errors may be noticed: the ill-fated Sir Richard Croft is referred to as Crofts, and the great French obstetrician Mauriceau appears throughout as Moriceau. The very interesting Chamberlen family tree given on page 72 could well be extended by reference to Peter Chamberlen's will as printed on pages 9-14 of Aveling's book on *The Chamberlens* (1882). This gives information concerning his wife Anne Cargill. Neither Aveling nor Dr. Radcliffe mention Peter Chamberlen's son David (1590-1618), who studied medicine at

Leyden, became a ship's surgeon in the East Indies Fleet, and bequeathed "fifty Jacobus pieces in gold" to Marischal College, Aberdeen (Smith, 1932).

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W. J. Bishop

1230

## ST. THOMAS'S HOSPITAL 1106-1947

This short account<sup>1</sup> of the development of one of London's most famous hospitals is intended for the layman rather than the medical historian, for in 72 pages it is not possible to do more than touch upon a few of the outstanding persons and events associated with the life of so old a hospital.

Once more the claim is made that St. Thomas's is the oldest of the London hospitals, although the author is unable to present any fresh evidence; all that can definitely be claimed is that, even before the Norman Conquest, there existed a religious establishment on the south bank of the river Thames adjacent to London Bridge, upon the site of which St. Thomas's Spital was standing in 1173. This site was continuously occupied by the hospital until the removal to Lambeth in 1871.

In so small a book it is possible to mention only a few of the medical giants who walked the hospital and taught in it in the past, but the author might have devoted a little more of his valuable space to this aspect of the life of the hospital, and less to nursing, which is very fully reported, especially in the second half of the book. Much space is devoted to the life of Florence Nightingale, even before she became connected with the hospital; of the 49 illustrations, 4 depict Miss Nightingale and altogether 10 are concerned with nursing. Of the remainder, 16 have no connexion with the hospital and only 3 consist of portraits of eminent St. Thomas's men (Cheselden, Mead and Sir Astley Cooper—the last named incidentally being more concerned with Guy's Hospital, to which he was full surgeon). An appropriate companion portrait to that of Dame Lloyd Still would have been one of the late Sir Arthur Stanley, for so many years, and despite much infirmity, the hospital's devoted Treasurer; he is not even mentioned. Sir Cuthbert Wallace, Sir Percy Sargent, W. Rowley Bristowe (*sic*), Sir Maurice Cassidy and Sir George Makins are mentioned only by name; much could have been written about each one of them. We look in vain for a word about the Ballances, Shattock, Mellanby, Sherrington, to name but a few who spring to mind, although space is found for a story about Keats and a note on Mr. Somerset Maugham, both of whom learned their medicine at St. Thomas's but made their mark in other fields.

While it is true that no hospital has contributed more towards raising the status of nursing in this country, it has done so only during the last 80 years—since the advent of Miss Nightingale. On the other hand it has been a hospital for almost a thousand years and its physicians and surgeons have made many fundamental contributions to medical science. There should, for instance, have been room for a story of Cheselden's operation for stone; instead he is described as St. Thomas's "greatest surgeon" who "specialized in anatomy and became a leading oculist as well".

Nevertheless, Mr. Graves gives a most interesting account of the hospital during its long life and has obviously taken great pains to verify his facts. When he approaches the period of the recent war he is on firmer ground. He gives a vivid account of the grave damage caused to the hospital by air-raids, and of the evacuation of much of the hospital and all the medical school to Surrey. He is able, too, to include some photographs showing the extent of the damage sustained, but he is quick to point out that, severely as the war has dealt with this great hospital, it has at least given an opportunity for rebuilding what was a fairly modern hospital on even more modern lines. He outlines the plans for future reconstruction and closes his story with the hope that nationalization will not affect the service of the hospital or the patients' faith in it.

The illustrations are beautifully reproduced, and 8 are in colour. In preparing the book, Mr. Graves has obviously obtained much

<sup>1</sup> [The secret instrument. For particulars see Book Reviews.]

<sup>2</sup> [For particulars see Book Reviews.]



of his information from the three-volume *History of St. Thomas's Hospital*, and from *St. Thomas's Hospital Gazette*, the one written by and the other founded by, the late Professor F. G. Parsons; yet we look in vain for the author's acknowledgement to one who laboured for several years to produce the only comprehensive history of the hospital.

L. T. Morton

1231

## THE STORY OF QUININE

A gaudy jacket, which promises "romance, bloodshed, and the glitter of gold" in a form comparable "to the most highly imaginative fiction", is a truer indication of the publisher's aim than it is of the author's, and it would be regrettable if this disguise were to deter the serious reader from approaching a work which is obviously the product of considerable literary research. Our judgement of the factual basis of Mrs. Duran-Reynals' history of quinine<sup>1</sup> is further prejudiced by the omission of "an excellent bibliography which includes many obscure and little-known primary sources", an item which, so Professor Fulton tells us in his preface, was included in the American edition of 1946.

This book is indeed a "pageant" rather than a history, for the author has chosen to illuminate a carefully selected series of dramatic events, each a milestone in the history of the exploitation of one of the most important drugs in the pharmacopoeia, and one which was described by Ramazzini as being capable of transforming the art of medicine as drastically as gunpowder transformed the art of war.

Introduced into Europe about the year 1639, its true value was for long a subject of violent dispute, while the fact that it was sponsored by the Jesuits brought it into the arena of religious controversy. The familiar story of Sir Robert Talbot, whose empirical use of the powdered bark won him fame and royal patronage in both England and France and secured its introduction into the official Pharmacopoeia of 1677, is followed by an account of the expedition which enabled La Condamine to give the first botanical description of the tree itself. The pitiful career of the English botanist Richard Spruce, who, on the slopes of the Andes, collected the seeds from which were grown the "red cinchona" plantations of India, the source of *totaquine*, is paralleled by the heroic gesture of the Indian, Manuel Incra, which brought eponymous fame to his master Charles Ledger (*Cinchona ledgeriana*) and led to the establishment of the great "quinine empire" of the Dutch in Java. In the concluding pages of the book we are given the story of the political and commercial hucksters, who "rigged the market" in order to maintain prices, restricting output of the previous drug while less than one-half per cent. of malaria sufferers—who comprise nearly a half of the world's population—were able to benefit from it. That is ironical enough, but it is—or was—an economic commonplace.

There is tragedy, in every sense, as well as irony, in the chequered history of cinchona, and nowhere is this so persistent and unyielding as in the career of the great South American naturalist José Celestino Mutis, and the establishment of "The Botanical Institute of the New Kingdom of Granada" at Bogotá. This, the first genuine scientific institution in the New World, was destroyed in the violence of counter-revolution, its director, Caldas, shot as a rebel, and the whole of its scientific documents, drawings and manuscripts, including the results of Mutis's life-work, seized by Spanish troops and shipped to Madrid, there to moulder unopened until the present decade. The story of this "great failure", which is comparatively unknown in this country, is undoubtedly the most valuable chapter in this book.

The writing is of the dramatic, occasionally sensational kind, but it is not unpleasant and the historical details are generally accurate. A few errors call for correction however. The *Schedula romana*, described as "a hastily written manual", was really a simple leaflet giving instructions for the use of the drug. The latter was first administered in England not in 1658, but certainly before 1655 by John Metford, a Northamptonshire physician whose case-book is now in the British Museum. Quinine, an alkaloid extract of cinchona isolated by Pelletier and Caventou in 1820, is confused anachronistically with the bark itself. The general medical background is hazy and sometimes wildly erroneous, as in the statement on page 71 that, in the year 1666, Harvey and Vesalius "had been officially repudiated

and it is doubtful whether the rank-and-file practitioner knew much about them."

However, if Mrs. Duran-Reynals has not given us the substantial work of irreproachable scholarship which the history of cinchona merits, we must acknowledge that she has written the most lively and stimulating sketch yet offered to the public.

F. N. L. Poynter

1232

## ANONYMUS LONDINENSIS

*Anonymus Londinensis* is the name given to a medical papyrus in the British Museum. It was first described by Sir Frederick Kenyon in 1892. An elaborate edition of the Greek text was brought out by Hermann Diels in the following year, and a German translation, with notes, by Heinrich Beckh and Franz Spät was published in 1896. The papyrus probably dates from the second century A.D., and represents a copy, made for private use, of an earlier work. In this edition<sup>1</sup> the Greek text of Diels has been reprinted together with an English translation, based on an amended text, and valuable notes. Dr. W. H. S. Jones, President of St. Catherine's College, Cambridge, who is responsible for the present work, is a classical scholar who has for many years made a special study of Greek medicine. He is already well known to medical historians as the author of a monograph on *Malaria and Greek history* and as co-editor, with the late Dr. E. T. Withington, of the *Loeb Hippocrates*. The translation is the part of the book to which Dr. Jones has devoted practically his whole attention. The original is full of almost insuperable difficulties, and few more competent authorities could have been found to undertake their solution.

The work known as *Anonymus Londinensis* consists of over 1,900 lines, and is divided into three parts, dealing with (1) definitions, (2) the etiology of disease, and (3) the history of physiology. A great part of the work appears to have been taken from the *Menoneia*, a collection of medical opinions attributed by some to Aristotle, but really written by Aristotle's pupil Menon. Some authorities think that the original of *Anonymus* was a series of extracts made by a student from Alexander Philalethes, a pupil of Asclepiades, who flourished at the beginning of the 1st century A.D., and is the latest authority mentioned in the text. Another theory, maintained by Max Wellmann, is that the author was Soranus of Ephesus, a physician of the 2nd century A.D. and a leading authority on midwifery and the diseases of women. The conclusion of Dr. Jones is that the papyrus is a copy, made by a medical student, of lecture-notes also made by a student, and containing elements derived from all the above-mentioned sources.

The first part of the work deals with the definition of such terms as "life," "soul," "bodily affection," and "psychic affection." Part two is concerned entirely with the causes of disease, which are reduced to two classes: (1) residues from food, and (2) disturbances in the blendings of the elements composing the body. Of the twenty medical authorities quoted, seven were unknown before the discovery of this papyrus. This section also contains a long account of Plato's medical views. The third section deals with the history of physiology after 300 B.C., from Herophilus to Alexander Philalethes, and is the most interesting as regards subject matter. A brief account of human anatomy is followed by a discussion of ideas of vitality and motion, nutriment, and the various emanations from the body. Special attention is paid to digestion, to the veins and arteries, and to the invisible "pores". According to Dr. Jones, certain statements in *Anonymus* provide the only reliable testimony for the doctrine of the historical Hippocrates, a point of considerable importance in view of the sceptical attitude which now prevails in regard to the works of the Hippocratic Corpus. Many of the problems posed by *Anonymus Londinensis* may never be finally settled, but as Dr. Jones remarks, "the Hippocratic problem, like the Homeric problem, cannot take from us our heritage."

In two supplementary essays Dr. Jones deals with the nature of Greek thought and the nature of Greek medicine, and gives a masterly exposition of the relations between medicine and philosophy in the ancient world.

W. J. B.

<sup>1</sup> [The medical writings of *Anonymus Londinensis*. For particulars see Book Reviews.]



# Book Reviews

## ALLERGY

### 1233 Synopsis of Allergy

Harry L. Alexander. Second Edition, London, Henry Kimpton, 1947. 255 pages; 22 figures. 20 x 13 cm. £1

(i) Historical; (ii) atopy; (iii) bronchial asthma; (iv) hay fever; (v) atopic rhinitis; (vi) gastrointestinal allergy; (vii) headache, conjunctivitis, other atopic disorders; (viii) allergic dermatoses; (ix) physical allergy; (x) drug allergy; (xi) serum allergy; (xii) bacterial allergy; (xiii) vascular allergy. Appendix. References.

Since the first edition of this book was published, the introduction of anti-histamine drugs has opened up a promising line of advance in the therapeutic field in allergic disorders. It may be that this fact has given to the physician an added interest in allergy. Many of the books written on the subject tend to be overburdened with the theoretical aspects rather than the known facts. A small book such as Professor Alexander has produced should satisfy the needs of a large number of people who require an up-to-date review of the modern trends of knowledge in the allergic disorders.

The author begins the book, after a brief historical survey, with some general considerations of allergic diseases. He stresses throughout the book the possible limitations of the skin test, which is of value so long as the limitations are understood. The differentiation of asthma into what is called atopic and intrinsic may be new to some workers. In atopic asthma there is often a positive personal and family history of atopic disorders and the skin tests are usually positive. This type, which usually begins in the 1st or 2nd decade, may react to environmental control. Intrinsic asthma on the other hand usually has no family or personal history of atopic disorders, the skin tests tend to be negative, the age of onset is after the second decade and the prognosis, even with proper treatment, is uncertain. The chapter on asthma has a lot of sound advice on possible lines of treatment.

The section on hay fever is the best in the book. In the USA the importance of ragweed as well as the grasses, as a cause of hay fever, may make it necessary for the patient to start treatment in February and continue until September. It is not surprising therefore that the author considers perennial treatment gives better results than pre-seasonal. Co-seasonal treatment is considered an emergency treatment rather than one of choice. More recent works, since this was written, suggest that co-seasonal treatment with a suitable anti-histamine drug gives results that are as good as any other method used.

The last nine chapters of the book deal with other aspects of allergy not related to asthma or hay fever. It is impossible in a synopsis not to be dogmatic, but even those workers whose opinion the author does not share are given more than adequate mention. In a book where such a wide field of knowledge is covered there are sure to be some gaps. The index is not full enough. A better photograph than that shown of atopic dermatitis should be found. British readers will be surprised to find no mention of the Noon unit in the standardization of extracts.

However, these are minor criticisms. The book can be strongly recommended as an easily-read account of modern ideas in allergy. There is a short list of references at the end of the book for those who require a more-detailed knowledge of allergic work.

A. W. Frankland

## ANAESTHESIA

### 1234 A Synopsis of Anaesthesia

J. Alfred Lee. Bristol, John Wright & Sons, Ltd., 1947. vi + 254 pages; 42 illustrations. 19 x 13 cm. 12s. 6d. [£0.625]

(i) Notes on the history of anaesthesia; (ii) respiration; (iii) pre-anaesthetic care and preparation; (iv) premedication; (v) inhalation anaesthesia; (vi) agents for inhalation anaesthesia; (vii) the closed circuit; cyclopropane; controlled respiration; (viii) nitrous oxide anaesthesia; (ix) accidents of inhalation anaesthesia and how to treat them; (x) gases used in association with anaesthesia; (xi) endotracheal anaesthesia; (xii) rectal anaesthesia—basal narcosis;

(xiii) intravenous anaesthesia; (xiv) analeptics; (xv) spinal analgesia; (xvi) regional anaesthesia; (xvii) refrigeration analgesia; (xviii) choice of anaesthetic as influenced by type of operation; (xix) choice of anaesthetic and methods as influenced by general condition of patient; (xx) the use of curare in anaesthesia; (xxi) shock; (xxii) anaesthesia in thoracic surgery; (xxiii) the complications and sequelae of anaesthesia; (xxiv) explosion risks in anaesthesia; (xxv) management of the unconscious patient; (xxvi) anaesthetic records; (xxvii) anaesthesia and analgesia in labour. Index.

This book would appear to be as good as any synopsis can be. It contains a précis of all the essentials of anaesthesia and analgesia, presented with a balance and lack of bias which is most refreshing.

Any book of this nature is meant for the student who has already read through a textbook and who has a sound knowledge of the subject by practical experience. He can then use it to revise any section quickly or to look up any facts or figures which he may have forgotten. On the other hand, the limitations of a synopsis should also be realized. The matter presented must of necessity be largely composed of stark statements without explanations or references. It is thus unsuitable for the novice and must not be regarded as a "cram-book" which offers an easy short-cut to knowledge.

The production of the book is excellent and the use of many different types breaks up the pages in an agreeable manner.

Proof-reading must have been exceptionally thorough, as only one error was detected by the present reviewer. On page 131, the strength of the intravenous drop of adrenaline is given as 1 in 125,000 instead of 1 in 250,000.

The book can be recommended without reserve to the class of reader for whom it is written.

C. Langton Hewer

### 1235 Curare: its History, Nature, and Clinical Use

A. R. McIntyre. Chicago, The University of Chicago Press; London, Cambridge University Press, 1947. vii + 240 pages; 25 illustrations. 25 x 17 cm. £1 7s. 6d. [£1.375]

(i) Curare and its meaning; (ii) the early history of curare; (iii) the first witnesses; (iv) botany; (v) chemistry; (vi) early experiments with curare; (vii) the actions of curare on nerve and muscle; (viii) theories of curarization; (ix) effects of curare on the circulation and respiration; (x) effects of curare on the viscera; (xi) absorption, excretion, and toxicity of curare; (xii) miscellaneous effects of curare; (xiii) curare and the central nervous system; (xiv) the clinical use of curare; (xv) conclusions and speculations. Addendum. Subject index. Author index.

This is an authoritative monograph sponsored by the University of Chicago Committee on Publications in Biology and Medicine; the author is Professor of Physiology and Pharmacology at the University of Nebraska.

The history of the discovery of the south american arrow poison is narrated with meticulous accuracy and with frequent quotations from the pioneer naturalists.

The various plants from which the crude curare has been extracted are fully described and illustrated in the chapter entitled Botany.

The pharmacological effects of the alkaloid on the various systems of the body are described in great detail and incorporate the research work carried out by the author with his colleague Dr. A. E. Bennett over a period of six years. It is interesting to note that Dr. McIntyre does not regard the electrical and biochemical theories of neuromuscular transmission as being antagonistic but complementary.

Only one chapter is devoted to the clinical use of curare and only four pages to its applications in anaesthesia but nevertheless the book is probably the most exhaustive source of information extant about the drug as a whole and can confidently be recommended.

C. Langton Hewer

## CANCER

### 1236 Cancer of the Breast

Duncan C. L. Fitzwilliams. London, William Heinemann Medical Books, Ltd., 1947. vii + 199 pages; 24 illustrations. 22 x 15 cm. £1 5s. [£1.25]

(i) The nature of the disease; (ii) spread of cancer; (iii) early diagnosis; (iv) clinical signs; (v) etiology and pathology; (vi) the treatment of carcinoma: early cases treated by local removal; (vii) treatment by operation; (viii) treatment by radium; (ix) treatment of late cases; (x) clinical types; (xi) other forms of treatment; (xii) X-ray therapy in carcinoma of the breast. Index.

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**Fatty Liver Disease in Infants in the British West Indies** by J. C. Waterlow. (1948). *Special Report Series No. 263.* Price 2s. net. By post 2s. 2d. This report describes and defines a serious nutritional disease of infants in certain tropical areas. Other work in this field is critically surveyed, and an effective link is established between the experimental effects of protein deficiency in animals and the clinical condition seen in these infants.

**Chemotherapeutic and Other Studies of Typhus** by M. van den Ende, C. H. Stuart-Harris, F. Fulton and J. S. F. Niven, with others. (1946). *Special Report Series No. 255.* Price 12s. 6d. net. By post 12s. 11d. The trial of two chemotherapeutic agents in the treatment of epidemic typhus fever in man is here described, together with a detailed account of the clinical forms of the disease and the laboratory findings. There is also included a number of important experimental studies on the immunology of typhus.

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The author expounds here in colloquial language his own ideas and experience of mammary cancer, and amplifies the text by case-notes. His advocacy of a more restricted operation than was the former custom is of particular value. In the past, surgeons have tried to overtake the spread of cancer by ever widening the field of operation. Modern inquiries, however, have shown that x rays can deal with the remoter extensions of cancer better than surgery alone; and radiotherapy after operation is therefore coming rapidly into general and effective use. The case-notes properly record mistakes occasionally made by the general practitioner or the surgeon when consulted by a patient with cancer of the breast. Tragic errors sometimes occur in this difficult field and the more that is known about them the less often will they happen. Procrastination is a great evil. Once cancer has begun it must be presumed to be spreading all the time, and the need for treatment is urgent. Mr. Fitzwilliams mentions the delay caused either by the patient's reluctance to consult her doctor, or by the doctor's hesitation to refer her to a surgeon; but he gives little attention to the prolonged interval which so often elapses between the advice to undergo an operation and its performance. This at present is part of a troublesome national problem, because of the paucity of hospital accommodation, and any detailed information about it would be acceptable.

Apart from the useful case-notes and description of surgical technique, the book contains several dogmatic statements which are questionable, and in some instances appear to the reviewer to be misleading. This comment may be illustrated by the quotations which follow:—

I remember reading of some experiments which showed that if carcinogenic substances were painted on the skin of an animal and a carcinoma established, and if that carcinoma was excised locally before dissemination had taken place, no subsequent painting of the skin would start a similar carcinoma. If this is true, the laboratory bears out what we see clinically, and leads us to believe that the growth of one carcinoma confers an immunity on the host against another similar growth starting.

Referring to involvement of the lymph nodes he states:

It should be realised that the importance of the lymphatic stage was only established at the beginning of this century . . .

Although the spread of cancer by the blood-stream has been known for more than a hundred years we are told that

. . . the clinicians have so far failed to realise its significance. The teaching in most medical schools remains much the same as when I was a medical student, namely, that sarcoma spreads by the blood stream, but carcinoma spreads by the lymphatics.

Discussing early diagnostic signs and referring to retraction of the nipple, he states:

This is a useful help in diagnosis, though unfortunately it is absent in the majority of cases.

And in a brief discussion on etiology, we read:

When our accepted theories of heredity have been so shaken by the recognition of the doctrines of Mendel, it is very difficult to be positive about heredity.

After mentioning the milk factor of mammary cancer in mice, he says:

In any case so few human mothers now suckle their offspring that the matter is hardly worth considering.

The illustrations on pages 87 and 88 and facing page 92, showing suggested arrangements of radium needles for the treatment of mammary cancer, appear to the reviewer to disregard the principles of dose-distribution on which such treatment must be founded.

An excellent chapter on the principles of x-ray therapy by Dr. Alice Ross is an addendum to this little volume.

Though it can be recommended to surgical technicians of experience who can form their own judgements, the book contains so many questionable statements that it cannot be regarded as a sound guide to the student or as an accurate exposition of the science of british surgery.

Harold Burrows

## 1237 Bioterapiya Zlokachestvennikh Opookholay

N. G. Klueva & G. I. Roskin. Moscow, Akademia Meditsinskoy Naook, 1946. 224 pages; 97 figures; 19 tables. 22 x 15 cm.

(i) Introduction. (ii) Inhibitors of malignant growth: mouse carcinoma and human carcinoma; general remarks on tumour-inhibiting substances; metals, lead; dyes as chemotherapeutic substances; heptyl aldehydes; carcinogenic hydrocarbons; immunotherapy; yeast. (iii) Bacterial products: mode of action; experimental and clinical studies on polysaccharides from *B. prodigiosus*. (iv) The action of toxins from *Corynebacterium diphtheriae* and *B. tetani*: treatment of transplantable tumours; treatment of spontaneous mouse tumours by diphtheria toxin. (v) Protozoan infections and transplantable tumours: Try-

*panosoma cruzi* infection and the growth of transplantable tumours; the specificity of *T. cruzi* action on transplantable tumours; the effect of *T. cruzi* and other protozoan endotoxins; *T. cruzi* and transplantable sarcoma; trials with "K-R" substance; the active part of the "K-R" substance; trypanosoma vaccines; vaccines prepared with alcohol, with metaphen; products obtained by lysis of *T. cruzi*; experiments with the "K-R" substances of the 3rd, 4th and 5th modifications. (vi) Histological and cytological changes in tumours induced by the carcinolytic substance; the action of *T. cruzi* on Ehrlich adenocarcinoma and Crocker sarcoma; the effect of the "K-R" substance on Ehrlich carcinoma and on spontaneous tumours in mice; histological and cytological changes in Crocker sarcoma induced by *T. cruzi* and the "K-R" substance. (vii) Summary and conclusions from experimental investigations. (viii) Preliminary clinical studies on the anti-tumour substance from *T. cruzi* ("K-R" substance); the purpose of clinical trials; description of cases; modifications of the "K-R" substance employed in clinical trials; carcinolytic syndrome; carcinolytic reaction and regeneration of normal tissues; the possibility of a cancer cure by the sole application of the "K-R" substance; the lytic reaction in various types of tumour tissue; induction of resistance in tumour cells and susceptibility of the body after repeated application of the "K-R" substance; relationship between the dose and the lytic reaction in tumours; mode of application of the "K-R" substance; subjective reaction after inoculations; local reaction; temperature; blood pressure; cardiovascular reaction; general reaction; preliminary results. (ix) Anti-tumour substance of *T. cruzi*: tropism and antagonism; properties of the anti-tumour substance from *T. cruzi*; mode of action of the "K-R" substance; treatment of Brown-Pearce carcinoma and its significance. (x) Conclusions. (xi) 133 References.

This is a monograph on the experiments carried out by Roskin and his collaborators on treatment of tumours with various bacterial and protozoal products.

It is felt that of the two main duties of the reviewer, description and criticism of the work, the first should receive foremost consideration in the present case. Hence an attempt will be made to acquaint the reader with the main points in the experiments and with the results described.

The book is divided into two parts. In the first, experimental, and in the second, clinical work is described.

The first part, preceded by a fairly comprehensive review of the many attempts to inhibit malignant growths, can be subdivided into a chapter devoted to the studies on treatment of tumours with diphtheria- and tetanus-toxins and a chapter on protozoan infections and tumours.

The treatment of transplantable Ehrlich carcinoma in mice with *B. tetanus* toxin gave complete regression of tumours in 19 out of 48 mice, and inhibition of tumour growth in 6 more mice, with an average decrease in tumour weight of about 5 times that of the control mice. Similar results were obtained with Flexner-Jobling carcinoma in rats and with Kritchevsky-Sinelnikov sarcoma in rats. Better results are claimed in the treatment of Ehrlich carcinoma with diphtheria toxin, where the dose and concentration play an important part. While treatment of Ca63 carcinoma in mice was disappointing, in Crocker's sarcoma the weight of treated tumours was 4 times smaller than that of the controls. The authors claim that diphtheria toxin inhibits the growth and induces the disappearance of tumours in a large percentage of animals, even in well-established tumours (of ten days' growth).

Diphtheria toxin was also employed in the treatment of 40 mice with spontaneous mammary tumours of various sizes. Unfortunately, the strain of mice is not mentioned, nor is the age of the tumours. Complete regression of tumours was recorded in 15 mice, diminution in tumour size in 18 mice, complete inhibition of tumour growth in 6 animals. It is a matter of regret that neither controls, nor data about the life-span of mice in which the tumours regressed, or the dosage employed, are mentioned. The experiments are accompanied by numerous drawings of mice with tumours and their progressive decrease in size is presented. The effect of the treatment is rapid: usually 7-14 days are sufficient to give complete regression of tumour growth. There are no histological descriptions of changes in tumour tissue induced by the treatment.

In the fifth chapter, on protozoan infections and tumours, experiments are described which date back to 1931. They were mostly carried out on mice with implanted Ehrlich adenocarcinoma. In an experiment in which 45 mice (strain not given) were infected with *T. cruzi* and at the same time implanted with Ehrlich carcinoma, the tumours disappeared in 30 mice, and tumour growth was greatly retarded in the 15 remaining mice. All the test mice eventually succumbed to the infection, but they lived longer than the control mice or the mice infected with *T. cruzi* but not implanted with tumours. In order to investigate the specificity of the *T. cruzi* effect on tumours, *Spirochaeta duttoni* and *Spirochaeta obermeieri* were tested against Ehrlich carcinoma, and *T. equiperdum* against a guinea-pig carcinoma (strain not stated), but they had no influence on tumour growth. The authors consider, therefore, the effect of *T. cruzi*





object of the series is to provide more-detailed analyses of important subjects than is possible in his Annual Statistical Reviews.

Dr. Stocks begins his study with a review of cancer mortality rates in various countries and the inferences made from them by previous writers on the subject. Marked differences occur between different countries in the mortality levels for cancer of certain sites, and the hypothesis that these can be explained by over-certification or incomplete certification in some countries is examined. Variation in mortality levels, however, is also to be observed within individual countries and this paper is primarily concerned with such variation in England and Wales.

Records of deaths over the last twenty years reveal that mortality from cancer of the stomach has shown little change amongst men between the ages of 45 and 64, but above this age the rate has increased by approximately 5%. Amongst women, on the other hand, stomach cancer has decreased generally. For all other sites combined the male rate has increased by 6 to 9%, compared with a decrease in the female rate of some 6%. Interesting features of the trend of lung cancer are the difference between the sexes, mortality having increased twice as much amongst men as amongst women; and the very great increase in certified mortality from this cause—the male rate being six or seven times as great now as it was twenty years ago.

For certain organs of the body important differences exist in mortality levels between administrative and geographical regions; for example, the proportion of deaths assigned to cancer of the respiratory organs to those of all sites is higher in London and the County Boroughs than in the Rural Districts. For cancer of the stomach, on the other hand, the position is reversed.

A significant correlation was found between comparative mortality from cancer of the stomach and certain environmental indices ( $r = 0.543 \pm 0.129$  with "persons per room" and  $r = 0.526 \pm 0.132$  with the "social class index") when the rates for males aged 45-64 in 30 large towns were examined. Cancer of the lung, in contrast, was not associated with environment in this way. Cancer mortality from 1921-30 amongst women aged 45-64 revealed that the highest comparative mortality (from cancer of the ovary, 116), and the lowest from cancer of the stomach, 82) were associated with the best social conditions. At the other end of the scale, the highest comparative mortality (from cancer of the stomach, 124 and uterus, 110), and the lowest (from cancer of the breast, 90 and ovary, 77), were associated with the worst social conditions.

Only the more striking correlations and contrasts have been mentioned above. In the sections on variations in mortality from certain sites, between social classes, environmental groups and other factors in England and Wales, Dr. Stocks discusses many interesting results, a full enumeration of which is not possible here. However, it is perhaps of interest to record the high negative correlation ( $r = -0.690 \pm 0.117$ ) found between mortality from lung cancer and hours of sunshine from the data of 20 towns.

The Metropolitan Boroughs of London provide a useful source of mortality data for an analysis of this nature in that a fair degree of uniformity of diagnosis, treatment, and climatic conditions is common to all. Further correlations revealed that amongst males aged 45-64 both cancer of the stomach and cancer of all sites except the stomach and lung were again highly and significantly associated with "persons per room". Again, cancer of the lung did not reveal this association. For women aged 45 and over, the standardized mortality rates from cancer of the stomach were highly correlated with the housing index ( $r = 0.715 \pm 0.094$ ), but with the same environmental index a high negative correlation ( $r = -0.779 \pm 0.074$ ) was found with cancer of the breast.

Mortality from some sites varied considerably between neighbouring boroughs in London and interesting contrasts emerged when the boroughs were grouped according to their source of water supply but "the curious correspondence in certain respects between cancer death rates and the sources of water does not prove that there is a causative connection".

In a foreword to the report the Registrar-General quotes the author as follows: "the purpose of this report is to present the statistical facts and point out any peculiarities in distribution and correspondences with other measurable factors which appear, so that all possible clues may be followed up by further study."

There is no doubt that this report achieves its purpose and it sets out the statistical facts in great detail.

E. A. Cheeseman

## 1239 Entstehung und Früherfassung des Portiokarzinoms

Hansjakob Wespi. Basel, Benno Schwabe & Co., 1946. 183 pages; 95 figures. 23 x 16 cm. Sw. fr. 18.

(i) Problemstellung; (ii) Historisches zur kolposkopischen Methodik und Diagnose und zur Kenntnis der Frühformen des Portiokarzinoms; (iii) die histologischen und kolposkopischen Bilder der normalen und pathologischen Portio; (iv) Grundsätzliches zur Frage des beginnenden Karzinoms; (v) die Einteilung und Nomenklatur des Portiokarzinoms und der übrigen Portioveränderungen. 1. Teil. Die Früherfassung des Portiokarzinoms. (i) Einleitung; (ii) das beginnende und das ganz kleine Portiokarzinom; (iii) kolposkopische Erfahrungen am fortgeschrittenen Karzinom; (iv) Statistisches zur Frage der Krebsfrüherfassung; (v) Schlussfolgerungen. 2. Teil. Die Entstehung des Portiokarzinoms. (i) Einleitung; (ii) die verschiedenen Formen des Portioepithels und ihre Beziehung zum Karzinom; (iii) Beobachtungen zur Frage der Krebsentstehung; (iv) Schlussbetrachtungen. Literaturverzeichnis.

The early diagnosis and treatment of malignant disease is, without doubt, the most important problem in clinical practice today. The cervix of the uterus is exceptional amongst the common sites for the development of carcinoma because it can be examined visually without much inconvenience to the patient. It is obvious on theoretical grounds that if the cervix of a patient is examined sufficiently frequently the origin and development of carcinoma of the cervix should be traced. Hinselmann's technique of examination of the vaginal portion of the cervix under binocular vision at a magnification of about 10 diameters, combined with the reaction of the epithelium to such chemicals as iodine, acetic acid, silver nitrate and salicylic acid, was soon shown to be of great value in the interpretation of pathological changes. Much credit is due to Hinselmann for his description of the different types of epithelium and for his Rubrik system of histological types.

Dr. Wespi, working in the University of Zurich, has used Hinselmann's methods for many years and has collected together in this small volume some valuable and excellent results. If gynaecologists learnt the contents of the book and if they employed the Hinselmann technique, they should be able to diagnose carcinoma of the cervix in its earliest stages almost with precision. Not only that, but they should be able to identify suspicious areas which are now known to be precancerous in character, when the cervix should be removed by simple amputation. Indeed, if the Wespi-Hinselmann methods were used extensively, the incidence of carcinoma of the cervix would be reduced and cancer cases would be available for treatment in their earliest stages. The book is of very great value in addition to its application, for it contains an almost complete summary of the literature, and the theoretical problems are considered both in a scholarly manner and in sufficient detail. These problems are notoriously of immense difficulty, yet Dr. Wespi approaches them courageously and gives a reserved judgement when final proof is not available.

Dr. Walter Schiller has written to the reviewer to record his high appreciation of Wespi's book, and to say that an effort is being made to have the book translated and published in the USA. Without doubt it is one of the most important contributions that has yet been made to the study of early carcinoma in the human subject.

## CARDIOVASCULAR SYSTEM

### 1240 Die Klinik der energetisch-dynamischen Herzinsuffizienz

Robert Hegglin. Basel, S. Karger, 1947. 120 pages; 82 illustrations. 24 x 17 cm. Sw. fr. 19

(i) Einleitung; (ii) die energetisch-dynamische Herzinsuffizienz als Problem; (iii) die Feststellung der energetisch-dynamischen Herzinsuffizienz; (iv) experimentelle Untersuchungen; (v) Vorkommen der energetisch-dynamischen Herzinsuffizienz in der Klinik; (vi) die klinische Symptomatologie der energetisch-dynamischen Herzinsuffizienz; (vii) die prognostische Bedeutung der energetisch-dynamischen Herzinsuffizienz; (viii) die Ursachen der energetisch-dynamischen Herzinsuffizienz; (ix) die Therapie; (x) Schlussbetrachtungen. Literaturverzeichnis.

The steady advance in cardiological research leads to increased emphasis on the dynamic events in the heart. During the last decade the techniques of determination of cardiac output have

undergone rapid development. When these have been combined with pressure measurements within the heart, remarkable revelations have occurred. For example, we now know that the signs of heart failure may be present when the resting cardiac output is normal or high, and we have also acquired useful quantitative ideas on the degree to which the pulmonary arterial pressure is raised in emphysema. The field of cardiology is no longer limited by the anatomical boundaries of the heart.

Dr. Hegglin has produced a book which will interest all who wish to consider deeply the problem of the failing heart. He discusses the modern physiology of muscular contraction and points out that fatigued muscle has long been known to contract and relax slowly. If the failing heart reacted in this manner, we should expect prolongation of systolic contraction, which would show itself by an increased interval between the first and second sounds and a prolonged QT interval in the electrocardiogram, assuming that the electrical events in the ventricle were closely correlated with the mechanical. Most ordinary forms of heart failure, however, do not show prolongation of the QT interval with the exception of some cases of hypertension. Some forms of circulatory failure may show a heart reacting somewhat differently. Systole may be shortened, leading to a diminution of the interval between the first and second sounds, but this shortened mechanical systole may be followed by delayed relaxation shown in a prolonged QT interval. Dr. Hegglin has made an extensive study of the duration of systole in experimental conditions and also in a variety of clinical states. He finds, for example, that the QT interval may differ quite significantly from the interval between the first and second sounds recorded graphically, and this is quite pronounced in diabetic coma, where mechanical systole seems to be very considerably shorter than electrical systole. A similar state of affairs is seen in hepatic coma and in severe alkalosis. These conditions may be associated with a low blood potassium. Hypocalcaemia leads to prolongation of the QT interval and simultaneous lengthening of mechanical systole. Discrepancies between mechanical and electrical systole are also seen in pneumonia, septic conditions generally, Addison's disease, and hyperthyroidism.

This syndrome, which he calls energetic-dynamic insufficiency, is characterized by the absence of venous congestion, and the short interval between the first and second sounds may be recognizable on auscultation. Pulse is often rapid and small in volume, with a reduced blood pressure, and the heart size is normal.

The author discusses in detail the possible significance of all these findings. Certain similarities with veratrine poisoning are indicated. In relation to the chemistry of muscular contraction he points out the importance of potassium in the release of energy from adenosinetriphosphate, and recommends giving saline infusions and potassium chlorate (4 g. daily) by mouth in treatment.

This is a refreshing monograph, with factual detail closely argued and full of interest. It is gratifying to see attention being paid to the heart in a variety of metabolic disturbances. Such work is likely to break down the artificial barriers enclosing the "specialities" and to compel attention to the integrated physiology of the whole organism, which is the real province of the physician.

J. McMichael

## 1241 The Peripheral Circulation in Health and Disease. A Study in Clinical Science

Robert L. Richards. London, E. & S. Livingstone, Ltd., 1946. xii + 153 pages; 104 illustrations. 25 x 18 cm. £1 1s. [£1.05]

(i) The anatomy and physiology of the peripheral vasomotor system; (ii) methods of study—with particular reference to the recording of skin temperatures; (iii) spontaneous variations in vasomotor activity; (iv) imposed variations in vasomotor activity; (v) occlusive vascular disease; (vi) the Raynaud phenomenon; (vii) peripheral nerve injuries; (viii) the immersion foot syndrome. Conclusion. Index of authors. General index.

In this monograph concerning the peripheral vascular system, Dr. Richards assembles information that he has gained as a result of clinical observations carried out to a large extent on cases with war-injuries. This is a study in clinical science, and no reference is made to treatment.

He deals in some detail with the anatomy and normal physiological responses and vasomotor reflexes of blood-vessels, and thereby indicates how they may be employed in assessing the circulation in a limb and the way in which they may be disordered in disease. As he rightly points out, no one clinical test is adequate by itself, and he stresses how, for example in the lower limb, reflex vasodilatation may not take place when the upper limbs are immersed in hot water even though the circulation be within normal limits.

He has also much to add that is of interest in the interpretation of skin-temperatures. His study of vascular changes associated with peripheral nerve injuries is instructive. He believes that tropic changes, formerly thought to be a specific sequel to division of peripheral nerves are, in fact, largely the result of disuse, as the same changes are seen if a limb is not actively utilized for any other reason. The "cold phase", which inevitably follows denervation, he attributes to a combination of postganglionic sympathectomy, subnormal metabolism in the part and no accumulation of the normal vasodilator metabolites. With regard to the etiology of the Raynaud phenomenon, no new explanations are offered, but the full discussion cannot fail to impress the reader how very unsatisfactory are the present concepts.

The book is attractively set out and well illustrated with photographs and diagrams and, with its comprehensive list of references at the end of each chapter, will prove informative, provocative and well worth reading by those with little or much experience in this field of medicine.

Donal M. Brooks

## DENTAL SCIENCE

### 1242 An Atlas of Dental Histology

Edgar B. Manley & Edward B. Brain. Oxford, Blackwell Scientific Publications, 1947. xi + 49 pages; 22 figures; 102 plates. 25 x 19 cm. 12s. 6d. [£0.625]

(i) Enamel; (ii) dentine; (iii) cementum; (iv) pulp; (v) periodontal membrane; (vi) alveolar bone; (vii) development; (viii) absorption; (ix) enamel cuticle (Nasmyth's membrane); (x) epithelial root sheath of Hertwig; (xi) gingiva; (xii) histological technique; (xiii) ground sections; (xiv) decalcified sections; (xv) staining methods.

This book is dedicated to the memory of Dr. A. W. Wellings, and is intended as a guide for the student in his laboratory work. It is obvious, from even a casual glance, that an enormous amount of work has gone into the production of such a range of specimens and photomicrographs. Every part of the tooth and its attachments is copiously illustrated and on the whole the reproduction is excellent. A book of this type will be of value to students generally, but in particular to those who have access to the authors' lecture notes. To the research worker and advanced student, this book may be somewhat of a disappointment in that the descriptive matter is far too short and the reader is left with a series of unanswered questions. It is felt that the lettering of the photomicrographs could be improved, as the white discs obscure an appreciable amount of the part of the specimen to which they refer, and that more arrows could be employed to advantage. A truly excellent photomicrograph (Plate 47) is shown of Von Korff's fibres, and the following plates illustrating the nerves of the pulp deserve high praise. In the section on Nasmyth's membrane, Plate 88, depicting ends of the enamel prisms at a magnification of 55, leaves much to the student's imagination. One has also seen better photomicrographs than that of an enamel cuticle, Plate 89, depicting the ends of enamel prisms.

A section is included on histological technique to fulfil educational requirements of the General Medical Council, but it is felt that this could have been improved if the typical staining reactions of the various stains listed were given. Staining reactions do vary, but their inclusion would be of considerable help to the junior student. As pointed out by Professor H. F. Humphreys in the foreword, it must be remembered that the book is intended to supplement and not supplant the textbooks. Nevertheless, it is hoped that when a second edition is called for a further elaboration of its present scope will be contemplated.

E. Matthews

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## DERMATOLOGY

## 1243 A Practical Textbook of Leprosy

R. G. Cochrane. London, Geoffrey Cumberlege, Oxford University Press, 1947. xi + 283 pages; 174 figures; 1 plate. 25 x 19 cm. £2 2s. [£2.1]

(i) Introduction; (ii) etiology; (iii) epidemiology; (iv) pathology; (v) diagnostic and other serological tests; (vi) signs and symptoms; (vii) classification and technique of examination; (viii) atypical lesions and the development of lesions; (ix) differential diagnosis; (x) reaction in leprosy; (xi) lesions of the nose, ear, mouth and throat; lesions of the eye; (xii) treatment of leprosy; (xiii) treatment of leprosy (continued); (xiv) treatment of leprosy (continued); (xv) treatment of neuritis in leprosy; (xvi) treatment of eye, nose and throat lesions; (xvii) treatment of trophic ulcers; (xviii) A. Treatment of syphilis in leprosy; B. Treatment of certain concomitant skin affections; (xix) A. Prognosis; B. Criteria of discharge and after-care; (xx) prevention of leprosy; (xxi) prevention of leprosy (continued); (xxii) practical methods of leprosy control. Appendices. Bibliography. Index.

As medical secretary to the British Empire Leprosy Relief Association and as Chief Medical Officer of the Lady Willingdon Leprosarium in Madras, the author has had a long and varied experience of leprosy. He has embodied that experience in the present work, which will be of interest to all leprologists. His reason for writing it is that he thinks that "... a practical textbook on leprosy would fill a gap between the type of book which deals largely with the theoretical aspects of the subject and the smaller pamphlets." In fact the text of his book is much longer, and unfortunately twice as expensive, as the standard English book on leprosy, by Rogers & Muir. It is somewhat uneven, for only two pages are devoted to the history of the disease and four to its etiology.

Epidemiology is rather more fully dealt with on modern lines, with emphasis on the low-age incidence, the great infectivity of the lepromatous type of the disease, and on the good prognosis of the tuberculoid form, the characters of which are illustrated in the pathological section by the author's photomicrographs. The prognostic value of the lepromin test and the want of any reliable serum diagnosis is brought out.

By far the best and fullest section is that containing well-illustrated clinical descriptions in which the important early symptoms are given special attention and the differential diagnosis of the different types of the disease is emphasized. The classification adopted by the Leonard Wood Memorial Conference on Leprosy (Cairo Conference, 1938) is used with some modifications. Atypical lesions are described in a separate chapter and are regarded as rare and intermediate between tuberculoid and lepromatous cases. Leprosy reactions are fully described and seven chapters are devoted to treatment, including that of the nose, throat and eye. The author relies on chaulmoogra preparations, but differs from most recent authorities in disparaging the use of sulphones, which have yielded such remarkable results in resistant lepromatous cases in the hands of Muir and of Louisiana workers.

The remaining chapters deal with preventive measures and are based mainly on the author's experience in Madras. Apart from some minor doubtful statements of an historical character, this section gives a good account of what is practicable under conditions in India; the importance of child leprosy, on which the author has written much, is stressed, as well as the segregation of infective cases, either in agricultural colonies, or if this is impossible because of lack of funds, in villages of their own. Because of the completeness of the clinical and treatment sections the work will be of practical value to leprologists everywhere.

## 1244 Atlas of Histopathology of the Skin

G. H. Percival, A. Murray Drennan & T. C. Dodds. Edinburgh, E. & S. Livingstone, Ltd., 1947. viii + 494 pages; 376 photomicrographs in colour. 24 x 20 cm. £3 15s. [£3.75]

(i) Terminology; (ii) normal histology; (iii) dystrophy and allied conditions; (iv) inflammation; (v) urticaria; (vi) lupus erythematosus; (vii) psoriasis; (viii) pityriasis rosea; (ix) lichen ruber; (x) pityriasis rubra pilaris; (xi) eczema; (xii) cheilopompholyx; (xiii) primary vesiculobullous eruptions of internal toxic origin; (xiv) primary vesiculo-bullous eruptions of external origin; (xv) pustular eruptions; (xvi) tinea; (xvii) rosacea and rhinophyma; (xviii) granuloma pyogenicum; (xix) traumatic injuries and the effects of stress; (xx) the reticuloses; (xxi) granulomatous conditions; (xxii) the naevi; (xxiii) cysts; (xxiv) tumours. Index.

The first reaction on turning over the pages of this new book is that the text is exceedingly brief for one so richly illustrated with coloured reproductions. However, on reading the preface one finds that the authors have, very fairly, already advised the student—and the reviewer—that the book purports to be an atlas and not a textbook of histopathology of the skin, and that their objective is "to portray in pictorial form the microscopical changes found in the more common diseases of the skin", the text being "severely limited just to what seemed necessary to explain briefly the processes illustrated".

The authors have certainly adhered rigidly to their intention in the greater part of the book. Exclusive of the descriptive notes beneath the illustrations, the text devoted to the subjects covered in the first 100 pages is written in about 450 lines, of which 52 are given to the Introduction, 50 to Terminology and 20 to Normal Histology, the remaining 325 being spared for the descriptions of "Dystrophy and allied conditions", "Inflammation", "Urticaria", "Lupus erythematosus", "Psoriasis", "Pityriasis rosea", "Lichen ruber" and "Pityriasis rubra pilaris". On reflection one cannot help but think that this is far too austere a use of words, particularly when the authors consider that the subject "Eczema" merits the relatively extravagant use of 320 lines.

The study of pathology of the skin is, like that of other diseases, by no means so simple that one can acquire sufficient knowledge by illustrations alone, and brief descriptions may not only be of little use but also prove very misleading. Of these there are many examples in the book, of which one may cite: "Sarcoid—the histological picture in the various clinical types of sarcoid is essentially that of a tuberculous process. The infiltration is circumscribed, it is deeply situated in the dermis and caseation is absent." Except for the last feature, most would disagree, for surely the picture differs considerably from the typical tuberculous reaction and "the infiltration", whatever that term denotes, is not usually situated deeply in the corium.

It is frequently argued that photomicrographs give a more accurate portrayal of a section than a drawing, an opinion with which the reviewer does not concur, for no matter how critical is the focusing, one must of necessity incorporate in the picture much that is above and below the plane of focus and which must therefore appear blurred, a factor which one eliminates on visual microscopical examination by frequent use of the fine-adjustment screw. It is for this reason that illustrations of cellular changes in the corium, as for example those found in chronic granuloma, prove of little value.

If only the authors could be persuaded to give rein to their extensive and valuable knowledge of the subject by enlarging the text and improving some of the deficiencies of illustration, the literature of this subject would indeed be considerably enriched.

## 1245 Skin Manifestations of Internal Disorders (Dermadromes)

Kurt Wiener. London, Henry Kimpton, 1947. 690 pages; 386 text-illustrations; 6 colour plates. 25 x 18 cm. £3 3s. [£3.15]

(i) The dermadromes of systemic infections; (ii-viii) systemic infections; (ix) helminthic diseases; (x) tuberculosis; (xi) dermatoses with claimed but still controversial tuberculous etiology; (xii) leprosy; (xiii) dermadromes of intoxications; (xiv) disorders of the circulation; (xv) diseases of the kidneys; (xvi-xx) disorders of the endocrine glands; (xxi) puberty; (xxii) menstruation; (xxiii) pregnancy; (xxiv) childbirth and puerperium. The skin in the newborn; (xxv) menopause; (xxvi) miscellaneous dermatoses with endocrine background; (xxvii) ageing; (xxviii-xxx) metabolic disorders; (xxxii-xxxiv) disorders of the blood and blood-forming organs; (xxxv) dermadromes of internal cancer; (xxxvi-xxxix) disorders of the nervous system; (xl) psychoses and psychodermatoses; (xli) disorders of the gastrointestinal tract; (xlii) diseases of the liver and pancreas; (xliii) disorders of the respiratory tract. Index.

A considerable proportion of the medical books published cover almost the same ground as others which are in current use. It is a refreshing change to find a book which deals with an unacknowledged aspect of medicine. The subject is treated broadly and in detail and all borderland topics are included.

The first 12 chapters are devoted to systemic infections and infestations. They include an account of the acute specific fevers with detailed descriptions of their exanthematous manifestations. Much of this material comes within the realm of a physician



rather than a dermatologist. The section entitled Dermatoses with Claimed but still Controversial Tuberculous Etiology contains a strange mixture: erythema nodosum, granuloma annulare, sarcoid, lupus erythematosus, and others. The etiology of these various disorders is discussed fairly.

Dermatitis medicamentosa is then discussed fully and includes an account of "atypical lichen planus" due to mepacrine (atabrine). This is followed by disorders of the circulation and of the kidneys. One of the illustrations suggests a confusion between Schamberg's disease and stasis dermatosis.

The most interesting part of the book is contained in the 15 chapters on endocrine and metabolic disorders. A brief description of each disorder is followed by a full account of its "dermadromes." The author's judgement seems to be faulty in suggesting estimations of the basal metabolic rate in all cases of vitiligo because this condition occurs in 10% of cases of thyrotoxicosis. A long list of dermatoses is given in which evidence has been produced for relationship to ovarian dysfunction, especially in individual cases, but the wise statement is made that "no dermatosis has been described which by its morphological picture alone would invariably permit the diagnosis of an ovarian dysfunction or disease." The section on puberty contains a particularly good and fair discussion of the part played by the gonads in *acne vulgaris*. The account of the dermatoses connected with menstruation, pregnancy, the puerperium, and the menopause abounds with information which is of great importance and which is by no means widely known. Under the heading "diabetes" Urbach's work on skin sugar and on "cutaneous glycoliposthia" ("dermal" would have been better) is described. The account of the vitamin deficiencies is orthodox. Among the conditions for which treatment with vitamin D may be given, *lupus vulgaris* is not mentioned.

The chapter on ageing includes a chronological account of the onset of wrinkles in the various areas of the skin. It is stated that the first wrinkles appear on the forehead and lower lids at the age of twenty-five.

As in all American works, the reticulososes are called "lymphoblastomas". The skin manifestations of leukaemia are divided into specific and non-specific. Following the chapters on the blood there are accounts of skin in internal cancer and in disorders of the nervous system.

The chapter entitled Psychoses and Psychodermatoses is the weakest in the book. It is interesting as far as it goes but is quite inadequate. The surprising statements, "Purely psychogenic urticaria is rare" and "purely psychogenic pruritus is rare", give a clue to the author's scepticism of the importance of psychogenic factors except as trigger mechanisms.

The final chapters deal with digestive and respiratory disorders. They are followed by seven tables, the first of which summarizes much useful information about the acute exanthemata. The second deals with diffuse pigmentations, the third with diffuse yellow pigmentations, the fourth with hypertrichosis, the fifth (an excellent and unusual presentation) with the skin in relation to age, the sixth with haemorrhagic diseases, and the last with pruritus. These tables are carefully compiled and make a valuable addition to the book. Unfortunately psychotherapy is not specifically mentioned in the list of ten treatments for pruritus. The index occupies 14½ pages, but could profitably be extended.

This is a very valuable reference book for dermatologists and probably also for the general physician. There are 3110 references, a considerable proportion of which pertain to the German literature. These references, in which there are a few misprints, are in the form of footnotes; at least one of the small numbers in the text is misplaced. The method of setting out the references seems to follow no system; in most of them the year follows the volume and page number, but in some it precedes them; in some the title of the paper is given in its original language and in some it is translated into English. There are a few surprising omissions, e.g., the books by Broster and his colleagues in the section on adrenal tumours, by Stannus on avitaminosis A, and Kuno in the section on sweating (though reference is made elsewhere to his work). Most of the 386 black-and-white illustrations are excellent but a few (e.g., fig. 17) are poor; some of the coloured plates are valueless. An immense amount of work has gone into the writing of this book and the publishers have produced it admirably.

E. Lipman Cohen

## ENDOCRINOLOGY

### 1246 Endocrine Function of the Hypophysis

Harry B. Friedgood. New York, Oxford University Press; London, Geoffrey Cumberlege, 1946. iv + 240 pages; 36 figures. 24 × 16 cm. £1 5s. [£1.25]

This book is reprinted from the Oxford Loose-Leaf Medicine and its presentation stands quite well alone, although it is not comprehensive. The first half of the book, on embryology and physiology, is not as good as the clinical sections, although great pains have been taken to give detailed references for many of the statements.

There is a slight confusion in the references to the cytology of the pars anterior (Tilney, 1938; Bucy, 1932) and the statement that the "cortical zone consists essentially of basophil cells" is quite contrary to the findings in man or to the original extraction of growth hormone from the bovine cortical rim of the anterior pituitary of cattle with its high eosinophil content. Of man, A. T. Rasmussen states quite clearly<sup>1</sup>, and it is also the experience of the pathological department of the London Hospital, that:

Histologically even more unreliability existed because of the habit of diagnosing the entire gland by general inspection of a single section, which too frequently was near the mid-sagittal plane. In the human hypophysis the distribution of the different types of cells is so irregular that nothing short of several horizontal sections suffice.

The acidophils tend to concentrate in a large area located somewhat posteriorly in each lateral half of the anterior lobe, leaving an area near the mid-sagittal plane and an anterior and a marginal zone where the acidophils are less numerous and hence richer in chromophobes and basophils.

A good deal of evidence is produced in favour of the basophil-cell origin of follicle-stimulating gonadotrophins, but it is also pointed out that luteinizing hormone is secreted by acidophil cells, which is not generally appreciated. The pathological physiology of exophthalmos is well dealt with and the long pages of closely printed matter are happily relieved in this section by excellent illustrations. The section on the complicated physiology and pathology of growth is excellent, with a very full bibliography. This section is followed by a sound clinical one on gigantism and acromegaly. The statement that "the growth of the hair on the head is remarkably thick" might be more qualified and is certainly not true of women, in whom it often falls out, as in primary virilism. The polyuria of acromegaly is well described but no reference is made to the opposite condition of diabetes tenuifluus, due to excessive secretion of pitressin, which may be present in some phases of acromegaly and is then associated with oliguria and excessive perspiration.

Attention is drawn to the fact that the epiphyses of giants "remain ununited many years beyond the period of normal ossification." This fact, not generally appreciated or known, does not refer to the tall eunuchoids, but to gigantism associated with an eosinophil adenoma or hyperplasia and must be ascribed (although this is not stated in the book) to the fact that hypogonadism is an accompaniment of the disorder. The statement is by no means true of all giants, and closure of the epiphyses may even be relatively premature, the great height being due to excessive secretion of growth hormone in childhood and early adolescence.

In summary, this is a good book, with full information on many aspects of a very involved subject, and deserves a place in the library of every scientific endocrinologist.

S. L. Simpson

<sup>1</sup> *The pituitary gland* (Proceedings of the Association for Research in Nervous and Mental Disease, December 1936), Baltimore, 1938.

### 1247 The Glands of Destiny: a Study of the Personality

Ivo Geikie-Cobb. Third Edition. London, William Heinemann Medical Books, Ltd., 1947. xii + 258 pages; illustrations. 22 × 14 cm. 15s. [£0.75]

Part I. (i) Introduction; (ii) the ductless glands and their secretions; (iii) the thyroid gland; (iv) the parathyroid glands; (v) the pituitary gland; (vi) the adrenal glands; (vii) the sexual secretions of the male; (viii) the female sex glands and their secretions; (ix) the internal secretions of digestion; (x) the pineal gland; (xi) the thymus gland; (xii) the internal secretions and the nervous system. Part II. (i) Personality and the internal secretions; (ii) the internal secretions in everyday life; (iii) racial characteristics and endocrine influences; (iv) from infancy to old age; (v) civilisation and warfare; (vi) on giants; (vii) on dwarfs; (viii) the present position of organotherapy; (ix) personalities; (x) the summing-up. Epilogue. Glossary. Bibliography. Index.

The sub-title of this book is "A Study of the Personality" and in this field it achieves a measure of success and historical interest. It is quite obvious that the writer is a man of culture and historical knowledge and a keen and thoughtful observer. Nevertheless the attempt to link his observations on personality with modern endocrinology, or even ancient endocrinology, is very weak and very often completely beyond any known facts. There is also a good deal of muddled and erroneous conjecture.

Of Henry VIII we read that "the anterior pituitary was probably somewhat countered by the posterior, otherwise the artistic element would not have been so marked"; of Queen Elizabeth, "the needs of a queen had called forth those glands which help to fight and to govern"; of James I, "his features and character point to a post-pituitary-thyroid dominant type"; of Charles I, "a little less of the posterior-pituitary and a stronger, better balanced, more masculine man might have resulted." All this may be very intriguing to the lay reader but to a scientific endocrinologist it is largely nonsense. This does not mean that the endocrine glands do not contribute to personality or that diseases of them may not seriously affect personality. A scientific treatise on this subject is yet awaited and maybe it is better to wait another decade before attempting it.

In the first section of the book, dealing with the function of the separate endocrine glands, there are innumerable mistakes. Thus a mongol, "like a cretin", is said to have "a puffy mis-shapen body with dry skin, subnormal temperature and slow pulse". Parathyroid deficiency is attributed to alimentary poisoning and the obsolete guanidine theory resuscitated. Pituitary feeding by mouth for obesity is advocated, whereas all scientific evidence fails to substantiate any such claims. "Anyone who can fall asleep at will would probably benefit from a stimulant to the pituitary gland." "Hypofunction of the adrenal medulla may exist as a disease entity, hypoadrenia." "The logical opposites of acromegals are the short swarthy goat-legged achondroplastics."

Although nothing can really compensate for such errors in a book dealing with endocrines there are interesting historical chapters on giants and dwarfs with case-histories and quotations. On the subject of glands and personality, the author unfortunately quotes from another book which has no greater scientific basis for many of its statements than his own. If the preface made clear that the book was for lay readers and that it had no scientific pretensions, it would serve the purpose of amusing and interesting without doing any great harm.

S. L. Simpson

## GERONTOLOGY

### 1248. Old Age: its Compensations and Rewards

A. L. Vischer. London, George Allen and Unwin Ltd., 1947. 200 pages; 9 illustrations. 22 x 14 cm. 12s. 6d. [£0.625]

(i) Senescence as a bodily and mental process; (ii) the duration of life; (iii) society and the individual: their attitude toward old age. Bibliography.

This book is an essay on the psychological and social aspects of old age written by one well qualified to do so in virtue of his twenty years' experience as physician to the Old People's Home of the city of Basle. The author is essentially a humanist, as is frequently displayed in his treatment of the physiological and pathological problems of senescence. His description of the gross changes in old age is excellent, but his explanations of them are such as must be regarded as unsatisfactory both by the scientist and the philosopher. Such statements as "life is gradual dying" and "ageing is a conflict between the nobler elements . . . and the simpler elements", though possessing attractions as artistic symbolisms, must remain unhelpful half truths.

Vischer shares the views of Bastai and Dogliotti that the actual cause of old age is an insoluble problem which is best left to the philosopher. It is to be hoped that the scientist of today approaching this problem of great interest and even greater social importance will not accept such an attitude.

In the second part of the book the author is dealing with matters of which he has very great knowledge. His main theme is that with successful adaptation of the individual and of society old age can be and often has been a phase of achievement which in its own way need not be inferior to or less happy than youth. His failure to draw a sharp line between mere chronological age

and physiological age weakens his position. He makes great play of the fact that a great painter given fifty years to develop his art may in the end produce finer pictures than in the beginning. This, of course, is a verifiable fact, but it does not dispose of the difficulty that a great many artists must have been prevented from their own further evolution by such conditions as cataract or paralysis agitans. Vischer's ideas concerning the compensations and rewards of old age presuppose as a minimum condition the preservation of the central nervous function. He forgets, however, that Montaigne said "en ay assez veu, qui ont eu la cervelle affoiblie avant l'estomach et les jambes".

This book has many merits. Where the author is calling upon his own experience concerning the care of old people, the nature of their needs and of the means of finding a place for them in society, he writes with great knowledge and understanding. In the latter half of the book, where he is reviewing the position of the aged in society throughout the centuries and the achievements of old people, he provides a veritable anthology of the best that both the past and present have to offer. His main contention that old age can and should be a stage of fulfilment rather than of frustration is well sustained by many examples from history and by the inclusion of some interesting reproductions which contrast the early and the late work of such masters as Titian, Tintoretto, Bernini and Renoir.

There must be but few who are interested in the problems of gerontology and geriatrics by whom this book will not be found both interesting and helpful.

F. A. E. Crew

## HEALTH THROUGH EXERCISE

### 1249. Physical Education

E. Harold Le Maistre. Melbourne, Oxford University Press; London, Humphrey Milford, 1945. xv + 310 pages; 67 figures. 22 x 14 cm. 11s. 6d. [£0.575]

(i) The history of physical education; (ii) the aim, objectives and principles of physical education; (iii) the scope and nature of physical education; (iv) safety in physical education; (v) the hygiene of physical education programmes; (vi) the relative value of physical education activities; (vii) anatomy and physiology; (viii) muscle location and action; (ix) tests and measurements in physical education; (x) posture; (xi) exercise and fatigue; (xii) tournaments and draws; (xiii) court, field and equipment specifications; (xiv) future trends in physical education. Selected bibliography for detailed references. Index.

This is a small compendium which is designed, in the words of the preface by Professor Harvey Sutton, "to bring before the teacher the scientific basis of the work, to set out a synopsis of our knowledge of structure and function of the human body, and also to furnish a wide variety of techniques for various sports and games in Australia." It thus deals with a wide variety of subjects ranging from a somewhat bare account of muscular attachments and actions, the physical activities of aboriginal Australians, the principles on which games shall be organized, physical tests and measurements and statistical methods, to the specifications for fields, courts and equipment, and a few data regarding gaseous exchanges in the body.

All topics are necessarily dealt with in a very abbreviated form, but as a work of reference it should be useful for the more administrative aspects of physical education. So far as the scientific aspects of human anatomy and physiology are concerned the very brevity of this book and the selection of its contents will tend to give teachers a superficial approach to a real understanding of the working of the body, and might indeed encourage the "cramming" of students, leaving their minds clogged with details of which they cannot appreciate the significance. It seems useless to enumerate the varieties of neuroglia, while the references to pH of the blood and to blood-buffers may convey a false sense of understanding unless the reader re-reads the elements of physiological chemistry elsewhere. The brief statements made regarding reflexes assist little in an understanding of their significance for physical education. Even the accounts of muscular actions are singularly incomplete; in the analysis of fundamental actions, the arm alone is dealt with. Nor is there any attempt at the analysis of the movements involved in exercises or games.

Mr. Le Maistre's book can be recommended as a convenient reference work in regard to simple details for those whose knowledge is already much wider than that presented by this book.

## MEDICAL HISTORY

### 1250 Magic and Healing

C. J. S. Thompson. London, Rider & Company [1947].  
176 pages; 20 illustrations. 22 x 14 cm. 15s. [£0.75]

(i) Magic and healing—early beliefs in the origin of disease; (ii) healing by incantation; (iii) healing and astrology; (iv) transplantation of disease; (v) healing by sympathy; (vi) healing by touch; (vii) healing in ancient Britain; (viii) Anglo-Saxon her; (ix) the healing art in ancient Britain; (x) the healing doctrine of signatures; (xi) the healing of plants; (xii) the healing of herbs; (xiii) plants of the devil; (xiv) herbs and plants dedicated to saints; (xv) plants and drugs used by sorcerers; (xvi) remedies of animal origin employed by the Anglo-Saxons; (xvii) precious and rare stones employed in healing; (xviii) man's body and its use in healing; (xix) magical girdles used in healing; (xx) magical and medicinal rings of healing; (xxi) magical stones of healing; (xxii) horns of healing; (xxiii) miraculous beds of healing; (xxiv) colours and numbers and their influence on healing; (xxv) toothache and its cure in antiquity; (xxvi) the psychological effect of magic in healing.

The author of this book, Dr. C. J. S. Thompson, who died in 1942, was an acknowledged authority on primitive medicine and on the art of the alchemist and the apothecary. That he loved to probe the mystery surrounding those subjects is evident from the fact that the word "Mystery" is included in the title of twelve of his previous works—*The Mystery of Poison*, of *Pharmacy*, of *Perfume*, or of *Astrology* and of *Apparitions* alike intrigued him and guided his pen to produce those fascinating and interesting studies.

The present posthumous work was left unfinished by the author, but it has been prepared for the press by his son and daughter, who are to be congratulated on the successful accomplishment of a difficult task. The only criticism, which many readers will share with the reviewer, is that this little work is overweighted with information, so that each page demands a serious study which rather detracts from the enjoyment of the reading. This difficulty is immensely increased by the absence of an index. For a work of this nature, an index is essential, and it is hoped that this defect may be remedied in future editions. The material is classified in 27 chapters. From *Early Beliefs regarding Disease*, we pass to *Healing by Incantation and by Touch*, to *Plants of the Devil and Plants of the Saints*, to *Magical Girdles*, *Medicinal Rings*, and *Miraculous Beds*, the *Doctrine of Signatures*, and the *Influence of Colours and Numbers*. The subject of medical folklore is immense, but its literature is relatively scanty. This new work is therefore to be accorded a welcome, a welcome somewhat saddened by the reflection that it is Dr. Thompson's last book. The illustrations are unusual and well chosen, but one misses a bibliography almost as much as an index.

Douglas Guthrie

### 1251 Joseph Lister : Father of Modern Surgery

Rhoda Truax. London, George G. Harrap & Co., Ltd., 1947.  
270 pages; 10 illustrations. 20 x 14 cm. 10s. 6d.  
[£0.525]

(i) The godless college; (ii) bachelor of medicine; (iii) the formidable; (iv) the killer in Glasgow; (v) the tragic Hungarian; (vi) living ferments; (vii) the killer revealed; (viii) test cases; (ix) presenting the evidence; (x) the discredited ligature; (xi) professor of surgery; (xii) innovations; (xiii) the vivisection controversy; (xiv) bitter opposition; (xv) the decision; (xvi) the centre of resistance; (xvii) storming the citadel; (xviii) the turning-point; (xix) antiseptics and asepsis; (xx) the long honeymoon; (xxi) Joseph, Baron Lister; (xxii) another Herakles.

This can scarcely be regarded as a new book. It is, indeed, the British edition of a biography which was first published in the USA several years ago. Nevertheless, as Lord Horder remarks in his illuminating foreword, "... we may surely welcome an edition of Rhoda Truax's biography of Joseph Lister in the country that boasts his birth and his life's work."

One may find it hard to realize that Lord Lister died as recently as 1912, and that only 82 years have passed since he first introduced the antiseptic method which was destined so soon to revolutionize the whole practice of surgery. The story of Lister's early life and training, of his adaptation of Pasteur's discovery of what was called "the germ theory" to the needs of surgery, of his struggle for the acceptance of his views, and of his ultimate complete success—all form a fascinating story and a noble theme for the biographer. Although there have been several biographies of Lister since the first authoritative work by his nephew Sir Richman Godlee appeared in 1917, there is still room and demand for a

short popular account, designed for the non-medical as well as for the medical reader. The work under discussion is a treatise of this nature, following conventional lines and portraying the old familiar facts, accurately and attractively, and all within the compass of 270 pages. It is a most interesting and readable description of the achievement of one of the greatest figures in the long history of medicine, who, by his introduction of the antiseptic method, earned so well the title of Father of Modern Surgery. The illustrations, rather poor, and bunched together in the second chapter, are a disappointing feature of the book, and there is a tendency to dramatize the facts and to introduce imaginary conversations to an extent less favoured on this side of the Atlantic than in America. There is, however, a useful index and a bibliography.

Douglas Guthrie

## MEDICINE AND LIFE

### 1252 The Occasion Fleeting

Hugh Barber. London, H. K. Lewis & Co. Ltd., 1947.  
viii + 199 pages. 22 x 14 cm. 15s. [£0.75]

(i) The pre-clinical years; (ii) the clinical years in a medical school; (iii) the provincial hospital years; (iv) medicine and morbid anatomy; (v) clinical acumen; (vi) the history and the signs; (vii) the consultant and the specialist; (viii) the spirit of the family doctor; (ix) the relatives and friends; (x) the art of the geriatrician; (xi) psychosomatic medicine; (xii) medical examination in the absence of symptoms; (xiii) the beginnings of disease; (xiv) medicinal remedies; (xv) pathognomy at the bedside; (xvi) doctors' dilemmas; (xvii) alcohol in its place. Bibliography.

This is a collection of essays, largely reminiscent in character, embodying the clinical wisdom acquired by the author during a long medical career of nearly half a century. The title will be known to all medical men, perhaps not to so many laymen, who may also read the book with pleasure and profit. It is a quotation from the first aphorism of Hippocrates,  $\delta \delta \epsilon \kappa \alpha \rho \rho \delta \varsigma \delta \epsilon \varsigma$ , and sets the tone for the whole work, which abounds in aphorisms, some original, many quoted. As examples of the former we may cite: "in diagnosis and treatment he gets the best results who has a receptive countenance"; "one generation is looking for a sign which may be discredited by the next, but clinical histories have a way of repeating themselves and live"; "right character, developed in childhood, is the best insurance against avoidable disease"; "examination passing is partly a necessary evil and partly good fun". Some of these aphorisms occur more than once in different essays, but criticism on this score is disarmed by a quotation from *The Autocrat of the Breakfast-table*: "He must be a poor creature that does not often repeat himself". Oliver Wendell Holmes, to judge by the frequency with which he is quoted, must be one of Dr. Barber's favourite authors: others are Laurence Sterne, Samuel Johnson, Robert Louis Stevenson, Lewis Carroll, Rudyard Kipling, and among medical writers Sir William Withey Gull, Sir William Osler, Sir James Mackenzie and Wilfred Trotter. Inserted between the essays are short fables designed to point the moral of what has gone before. Like most attempts of this kind they are apt to be somewhat dull, and thus fail to achieve their purpose.

Dr. Barber has a wealth of anecdotes, which are indeed one of the most attractive elements in his book, but his concluding remark, "one could write an essay on that", falls through too constant repetition. We like particularly the story of the country practitioner who was thrown into a ditch from his motor bicycle and knocked unconscious. On coming to, he found a ring of people standing over him and heard a voice saying, "Well, there now, if it isn't our own dear Doctor, and we've sent for him to come and see himself". There is also the slightly "naughty" one about the young married woman who wished her doctor to attend at her confinement, but was emphatic that she could not ask him to call to fix up the date, because it was his invariable custom on entering the room to say, "Well! What have you been doing?"

If one can attempt to catch any general theme running through the various essays of this book it is a somewhat wistful eulogy of the old-fashioned "family doctor", a term that Dr. Barber prefers to general practitioner. While recognizing and acknowledging the advantages brought by recent advances in medical science, he repeatedly expresses the view that we have lost something too in the passing of the older methods and customs. One

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gathers, as much by reading between the lines as from any direct statements, that Dr. Barber views with some apprehension the advent of a national health service. In the following passage he even allows a note of cynicism to creep in which is foreign to the general tone of the book: "There will be less room for individual worldly wisdom in a new world which may believe itself to be wise; although it may behave a young man to touch his cap to a superior officer". Nevertheless the evils of the financial basis of private practice are exposed in several passages; for instance, "... it would have been rather nice to have refused to price a particular service; and this is one of the privileges of the honorary staff to a hospital"; or again, "... it is probable that there is no other calling in which the conflict between the scientific side and the financial side is so acute as it is in medicine". An example of how financial considerations may complicate practice is given in the chapter on the art of the geriatrician: "a young doctor's first idea should be as to whether he can earn the money; by which I mean deserve it". In another connexion however the profit-motive is upheld: "In British medicine, of which we are justly proud, the consultant has relied economically upon the support of the family doctor. It has been an excellent stimulus." Moreover, in one of the longest passages of the book devoted to a single topic, Dr. Barber defends in no uncertain terms the buying and selling of practices, concluding with the triumphant parting shot: "If the new service shows shortcomings in some directions, as well it may, I only wish to state that it must not be claimed as a set-off, that the public have been saved from the indignity of being bought and sold like chattels, because for those members of the community whom it concerned the results were excellent".

One of Dr. Barber's chief interests apart from medicine is obviously cricket, for metaphors and analogies from the game occur constantly throughout his book, and he proudly claims the most distinguished player as a member of his own profession. There stand out from these pages not only a charm and urbanity of manner but also a kindly, tolerant spirit that we believe it is not altogether fanciful to attribute to Quaker influence: the author's grandfather was a Quaker and he himself was at a Quaker hall of residence while a student at Manchester. The quotation from William Penn's *Fruits of solitude*, at the head of the essay on the consultant and specialist, is also significant.

We can imagine no more appropriate gift for a retired "family doctor" or layman with a "medical background" than *The occasion fleeting*, and we hope the author will not take it amiss if we describe it as an ideal bedside book. If we have read his character aright, he will not do so.

Cyril C. Barnard

## 1253 The Doctor's Job

Carl Binger. London, George Allen & Unwin Ltd., 1947. 243 pages. 22 x 14 cm. 12s. 6d. [£0.625]

(i) Background and changes; (ii) specialties and specialists; (iii) the choice of physician, medical fees and etiquette; (iv) the relationship of doctor and patient; (v) medicine and psychoanalysis; (vi) psychiatry and medicine; (vii) some common psychiatric problems; (viii) psychosomatic medicine or mind and body relationships; (ix) stomach ulcer; (x) allergy, asthma and tuberculosis; (xi) high blood pressure; (xii) the cure and control of disease; (xiii) recent achievements and tasks ahead; (xiv) convalescence and chronic disease; (xv) the prevention of illness; (xvi) office practice, hospitals and outpatient departments; (xvii) socialized medicine or paying the piper; (xviii) past, present and future. Bibliography. Index.

It is a pleasure to review a book like this, written evidently by a man who has put into it not only his great learning and experience, but his heart. This is clearly shown by the conclusion announced by the author in his introduction: "Nothing a man has of scientific acumen, personal integrity and human understanding is too much to bring to this job." In one reader at least the book created not only an increased pride in his profession but a lingering doubt whether anyone but a superman is equal to this task.

Dr. Binger deals with every aspect of medical work and always with emphasis on its effects on the mind and body of the patient, who is continually in the picture. He shows what a complicated and costly business the prevention, diagnosis and treatment of disease have become. In spite of sympathetic references, the author comes to the conclusion that in a modern industrialized world the day of the general practitioner is past. His place is to be taken eventually by the trained internist working mainly in a hospital or centre with co-operation whenever necessary with

the specialists. The number of these in the USA is indeed formidable—no less than 26 varieties officially recognized. Dr. Binger has some very wise remarks on their limitations as well as their virtues, and on the best ways of using them.

A particularly noticeable feature of the book is its insistence on the interaction of mind and body. Dr. Binger says, "The approximation of psychology and medicine is one of the most important steps, as yet perhaps not fully appreciated, which modern medicine has taken." His chapter on the psychiatrist, while cleverly dispelling some of the "mystery-man" atmosphere which has grown around him, is absorbing and to me convincing. Another of Dr. Binger's dicta is almost a summary of his intention in writing this book: "It is almost as important to know what kind of a patient has the disease as what kind of disease the patient has."

Tempting as it is to dwell on each chapter of the book I must resist it and come to the section which deals with the crucial question of how this complicated and expensive modern medicine can be brought within the reach of the ordinary citizen—a problem which is exercising the minds of politicians as well as doctors all over the world. Dr. Binger points out that even in the USA, the world exemplar of private initiative and voluntary effort, the socialization of medicine is making great strides. "At least three-quarters of the total number of hospital beds in the United States are paid for out of public funds," he states, and he evidently believes that this tendency will extend to other forms of practice. He speaks very sympathetically of the many interesting experiments in voluntary prepaid medical insurance and group practice but regards them as merely touching the fringe of the problem. A criticism I must offer on this part of the book is that Dr. Binger does not seem sufficiently to appreciate the potential dangers to the best traditions of our profession, and to the public, if and when the State becomes the chief paymaster, instead of the patient.

This fine book is one that every doctor and medical student would profit by, and it can be just as cordially recommended to the intelligent layman, for the thought and hard work that have gone to its making are concealed by the ease and lucidity of its style.

Alfred Cox

## 1254 János, the Story of a Doctor

John Plesch. London, Victor Gollancz Ltd., 1947. 579 pages; 37 illustrations. 20 x 13 cm. 18s. [£0.9]

Part I. Science, politics and personalities. Part II. The theatre, art, music and England. Appendix: a doctor's dialogues. Index.

Although the subtitle of this book is *The Story of a Doctor*, it seems more important that it is the story of a highly intelligent and versatile man: his life, his opinions and his anecdotes. As the first has been exceptionally rich and varied, the second are sound and freshly stated, and the last are harvested from intimacy with many of the great ones of Europe (among them Einstein, Kreisler, Reinhardt), it is full of interest.

Like too many autobiographies it is almost formless, resembling a life-time notebook arranged loosely into sections and into some chronological order. The writing is diffuse and without style, although this no doubt is partly because the book, as we have it, is a translation—from what language, curiously enough, the publishers do not tell us. It would be hard even to guess the language of the original, since according to the author's own account he has at different periods of his life used Turkish, Hungarian, German, Slovakian and "quite a smattering of Roumanian." It is hardly necessary to say that Dr. Plesch grew up in the polyglot, patriarchal atmosphere of the Austro-Hungarian Monarchy, where he learnt not only his languages, but acquired an early love for the arts, particularly music, and for medicine. "I grew up amongst doctors," he writes, "and from my earliest childhood I never had any other idea but to become a doctor myself." Yet for some time he seems to have faltered in his choice of profession, until the unnerving privilege of once conducting the crack band (usual conductor one Franz Lehár) of the austro-hungarian army, after which he finally renounced music in favour of medicine. Because the terms in Hungarian universities started and ended at different times from those in the rest of Europe, during the long summer vacations he was able to go to the great medical centres of Austria, Germany and Italy—"to any place where some great man was at work whose reputation attracted me."

He was in Berlin five years before Virchow's death, made his acquaintance and watched him dissect. After Hitler's rise to power Plesch, with his wife and three children, came to England, where he requalified and settled.

The author's own character and versatility, as well as his exceptional opportunities, must have helped to form the extraordinary galaxy of friendships of which the anecdotes adorn this book. The multitude of accounts of the notable or notorious of Europe between the two world wars is almost bewildering and it is often difficult to disentangle authentic personal experience from hearsay.

In the search to discover a satisfactory explanation of the purpose of life, Dr. Plesch accepts Goethe's motto, "that the practical solution is that life is there to be lived." He employed this motto not only in his advice to some of his patients, but lived up to it fully himself. It is a pity that occasionally his words (or those of the translator?) give the impression that the author is too conscious of his achievements, which left the reviewer sometimes with an embarrassed sensation. One tends, however, to forgive such slight indiscretions from a man who is not only knowledgeable in his profession but also a connoisseur of the values of civilized life. Apart from music, in which he showed talent in early youth, one of the illustrations in the book, a portrait of Einstein by the author, bears witness—to say the least—that he could paint, and he also had wide knowledge of the European stage, its actors and producers.

But not the least interesting are the author's opinions. Here he is often unorthodox, sometimes provocative, but never stupid. He advocates euthanasia, legalized abortion and tolerance of homosexuality. He says many wise and often original things about marriage, sex and about the doctor-patient relationship. He believes in moderation not only in the natural good things of life, but also in sport and in fresh air—a refreshing conception!

By opening the book at the index first, the reader may get a very good idea of the number of subjects treated—indeed, the author shows some immoderation in inclusion of subjects—but on all of them he displays humanism, humour, and open-minded intelligence.

G. Popják

## MICROSCOPY

### 1255 The Microscope and the Practical Principles of Observation

Theodore Stephanides. London, Faber & Faber Ltd., 1947. 160 pages; 20 illustrations. 22 x 14 cm. 10s. 6d. [£0.525]

Part I. Description of the microscope. (i) the stand; (ii) the optical system; (iii) choice of a microscope. Part II. Technique of microscopical observation. (iv) Illumination by transmitted light; (v) illumination by diffracted light or dark-ground illumination; (vi) binocular microscopes; (vii) methods for recording observations. Bibliography. Appendix. Index.

It is a curious fact that, perhaps more than any other instrument, the microscope has attracted the attention of those who in the best sense of the word are "amateurs". Such amateurs as Joseph Lister, Nelson and Barnard have made most important additions to microscopy. It is therefore not surprising to find that the writer of a book on the microscope is a Greek poet, who happens also to be a medical man.

Many books on microscopy describe fully the preparation and staining of animal and plant tissues and other objects for microscopical study but give little or no instruction as to their examination when actually upon the stage of the microscope. The present volume attempts to meet this want by giving a methodical survey of the technique of microscopical observation. Although it is written primarily from the medical angle the fundamental principles remain the same for all branches of microscopy. The first part of the book gives a systematic description of the microscope, with instructions on the choice of an instrument for particular purposes. Especially important is the insistence on a microscope with the standard Royal Microscopical Society's eyepiece, objective and substage diameters. The second part of the book deals with the technique of microscopical observation and here even those who are expert microscopists may discover points of interest, though they will by no means agree with every statement made. The causes of errors of interpretation due to bad centring of the optical system, bad

focusing of the condenser, bad regulation of the illuminating cone and bad correction for spherical aberration are well described. Information, not always easy to find in works on microscopy, is given on simple methods for determining the dimensions of an object, its shape and position. A bibliography of books giving more information on particular questions and an appendix with definitions of terms used in microscopy complete a useful if elementary book, which incidentally is written in impeccable English.

G. M. Findlay

## NERVOUS SYSTEM

### 1256 The Physical Background of Perception: Being The Waynflete Lectures Delivered in the College of St. Mary Magdalen, Oxford, in Hilary Term, 1946

E. D. Adrian. Oxford, Clarendon Press, 1947. 95 pages; 21 figures. 22 x 14 cm. 10s. [£0.5]

(i) The brain and the mind; (ii) the sense organs; (iii) motor and sensory areas of the brain; (iv) sight and hearing; (v) the electrical activity of the brain; (vi) recognition and mental events.

This little volume comprises the six Waynflete lectures delivered by Professor Adrian in Magdalen College, Oxford, in 1946. They are written for the enlightened layman, in that fluent style of his which by its simplicity of expression and modesty of exposition leads the reader to assume that to reveal all this was simple, and to synthesize the evidence revealed, easy. In point of fact the volume contains an account of Professor Adrian's recent original work on the excitable cerebral cortex, much of which has been published in *Brain* and the *Journal of Physiology* in the past few years.

He relates, within the limits of our knowledge, the representation of sensory function at the periphery and cerebral cortex and links the form of his representation to the biological importance of that function to the particular animal under review. From this he goes on to an account of the integration of the cerebral activity subserving the special senses, and to a discussion upon the meaning of the apparently spontaneous electrical rhythms which can be recorded from the brain. He ends with an essay on learning and memory.

Even those who are well versed in the electro-physiology of the central nervous system would do well to pause for a time and ponder the integration of evidence which this monograph represents. Those less directly concerned will be fascinated.

Denis Williams

### 1257 Anatomical Pattern as the Essential Basis of Sensory Discrimination: being the Forty-ninth Robert Boyle Lecture

W. E. Le Gros Clark. Oxford, Blackwell Scientific Publications [1947]. 16 pages. 22 x 14 cm. 1s. [£0.05]

Professor Le Gros Clark's Boyle lecture contains a combination of new information and speculation that makes it a very good shillingsworth for medical men, biologists, philosophers or any others interested in the problems of perception. He first summarizes some recent work on the arrangement of the nervous pathways connected with some of the sense organs. The earlier neurologists were content to describe the connexions between receptor and central nervous system and the pathways within the latter. The lines of two paths thus became very well known, and it was commonly supposed that anatomical investigation of these matters was now "complete". More recently neurologists, largely under the leadership of Le Gros Clark himself, have realized that the details of the arrangement of nerve fibres within the pathway and centres may be of the utmost importance. In some cases (e.g. the eye and ear), there is a point-to-point connexion between individual organs of the receptor surface and parts of the brain. But the distribution of the points relative to each other is not the same centrally and peripherally; there is an elaborate sorting on the way inwards. It is now becoming clear that the detailed arrangement of these connexions with the projection area is a matter of very great importance for the functioning of the sensory system. Here is a vast new field for

the anatomist to explore and this is a beautiful example of the truth that a study seems to be complete only when those who pursue it have not sufficient imagination to carry it further. The detailed study of the connexions of the sensory fields will claim the attention of anatomists and histologists for many years, especially as physiologists, using the clues provided by the anatomical studies, come to investigate the processes going on in these areas, and in turn suggest further studies of the distribution of the various elements.

At the end of his lecture, Le Gros Clark deals with a problem perhaps even more fascinating—how all these extremely specific connexions come to be made during development. Discarding the theory that growing nerve-fibres are directed by chemical influences, he suggests, following Weiss, that they are controlled by the ultra-structure of the matrix in which they grow. It might be added that recent workers, Beams and Marsh, have revived an older idea that electrical potential gradients influence the direction of growth and the whole question remains very open. As Le Gros Clark points out, the view that fibres grow along surfaces only pushes the problem back to a consideration of "the incredibly complicated ultra-structural pattern of the substratum in the early embryo". He points out that this, like all living patterns, is not a static anatomical unit, but is only "mirrored" in a continually-changing substratum, as is a reflexion in a running stream. The analogy is telling enough but it is startling to find him pursuing it in a final sentence to the question: "What is the living body a reflection of?" There is evidently material here for much discussion and thought, and the lecture is an excellent example of the stimulus that can be obtained by combining accurate observation with imaginative thinking.

J. Z. Young

## 1258 Diseases of the Basal Ganglia and Subthalamic Nuclei

D. Denny-Brown. New York, Oxford University Press; London, Geoffrey Cumberlege, 1946. [Reprinted from Oxford Loose-Leaf Medicine] iv + 116 pages; 4 illustrations. 24 x 16 cm. 12s. 6d. [£0.625]

This short monograph is Dr. Denny-Brown's contribution to the Oxford Loose-Leaf Medicine, republished separately. In it, the author has collected all the major contributions to our knowledge of this corner of neurology.

The sections in which he deals with the symptomatology of the major and minor syndromes caused by disorders of the basal ganglia are accurate, lucid and pleasant to read. The most important part of the monograph, however, is the introduction, in which the underlying anatomy and physiology of the disturbances are synthesized in a manner characteristic of the Sherringtonian school of neurology.

This chapter of a well-known medical textbook is in the first rank of descriptive medical writing.

## 1259 Sensory Mechanisms of the Retina with an Appendix on Electrorretinography

Ragnar Granit. London, Geoffrey Cumberlege, Oxford University Press, 1947. xxiii + 412 pages; 178 illustrations. 22 x 14 cm. £1 15s. [£1.75]

Section I. The electrical signs of excitation and inhibition in the retina and optic nerve. (i) The generation and inhibition of a rhythmic discharge in peripheral nerve. The nerve as a model sense organ; (ii) the electroretinogram and optic nerve response of some simple types of retina; (iii) the components of the vertebrate electroretinogram; (iv) the resting potential. Some further properties of the component potentials of the electroretinogram; (v) some characteristic properties of the discharge in isolated fibres of the optic nerve; (vi) the component potentials in relation to excitation and inhibition: summary of chapters i-v. Section II. The properties of rods and cones. Variations in area, intensity and duration of the stimulus in dark and light adaptation. "Flicker." (vii) The duplex nature of the retina as reflected in the electroretinogram; (viii) differentiation velocity as a function of the state of adaptation. The response to intermittent illumination; (ix) quantitative effects of variations in the strength of the stimulus; (x) the duplicity theory from the electrophysiological point of view. E- and I-retinas defined. Summary of chapters vii-x; (xi) interaction. Area, duration and intensity of the stimulus as interchangeable variables; (xii) some other forms of interaction. Synchronization. Section III. The properties of the photosensitive substances and the mechanism of excitation. (xiii) The absorption spectrum of visual purple and its photo-products. Visual violet; (xiv) chemical aspects of the problem. The significance of vitamin A; (xv) the regeneration of visual purple; (xvi) the photochemistry of visual purple. The spectral distribution of its sensitivity and the scotopic

luminosity curve; (xvii) light and dark adaptation. Section IV. Colour reception. (xviii) The nature and history of the problem; (xix) colour receptors in different types of retina; (xx) the dominator-modulator theory; (xxi) the composite nature of the photopic dominator system, the mammalian colour receptors; (xxii) the dominator-modulator theory and colour vision. Appendices. References. Author and subject indexes.

Newcomers to visual physiology are fortunate in that within recent months two modern contributors to this field of study—Dr. W. D. Wright and Professor Granit—have written monographs. Books of this kind not only lighten the reading of the novice, but also serve to underline and crystallize the views of the author upon vision as they stand today. Scientific papers do not always do this, because their appearance in print is often followed by maturer consideration, which may never achieve full weight except in a monograph of this kind.

Professor Granit's book is such a crystallization of views and, in addition, an extensive digest of the author's own experimental work. It is a book which everyone interested in visual physiology should make a point of reading.

The work is divided into four sections. Section III gives a concise account of the physiology and biochemistry of visual purple and related photosensitive substances. The section explains all the names used by other workers and discusses the interrelationships of the various pigments. There is one chapter devoted to light and dark adaptation and the review of the photochemical aspects as a whole is one of the best in the literature.

Section IV deals with colour reception and in Chapter 20 the author's dominator-modulator theory is fully stated. This theory, as many people will know, is based upon action potential records obtained, by the author's own microelectrode technique, from single (or at most a few only) optic nerve fibres. It is a pity that the details of this technique are so poorly described. One felt that one would like to know much more of the actual method itself. In the final chapter the author links his work with that of those who investigate vision from the subjective aspect and this part of the book, which might well have become extremely speculative, is quite in balance with the rest of the matter. Here the importance of the electrophysiological approach to colour vision is stressed. It has revealed, for example, the presence of the photopic dominator type of response from a single fibre; this fibre has a spectral sensitivity curve which covers most of the spectrum and could not be of much use to the animal for wavelength discrimination. The author recalls that v. Kries and several others of the older workers realized the partial independence of the sensations of colour and brightness—an independence which they found difficult to harmonize with the trichromatic theory and which is easily explained by assuming that the photopic dominator is a brightness receptor.

Sections I and II deal with the author's work on the electroretinogram and other electrical behaviour of the retina and optic nerve. Although these sections provide a clear account of the work, the general reader will not find them easy to read. Here the author stresses the importance of correlating the nerve discharge with the electroretinogram.

There are 34 pages of references.

## OTORHINOLARYNGOLOGY

### 1260 Lehrbuch der Hals-Nasen-Ohren- und Mundkrankheiten

Edited by A. Barraud, F. R. Nager, L. Rüedi, E. Schlittler & J.-P. Taillens. Basel, S. Karger, 1947. xii + 609 pages; 177 illustrations. 25 x 17 cm. Sw. fr. 60.

I. Allgemeiner Teil. (i) Allgemeine Untersuchungstechnik; (ii) spezielle Untersuchungsmethoden für Mundhöhle, Rachen, Nase, Kehlkopf und Ohr; Tracheo-Bronchoskopie und Ösophagoskopie; Röntgenuntersuchung, Diaphanoskopie. II. Spezieller Teil. (i) Die Erkrankungen der Mundhöhle; (ii) die Krankheiten des Rachens; (iii) die Erkrankungen der Speiseröhre; (iv) die Krankheiten der Nase und ihrer Nebenhöhlen; (v) die Krankheiten des Kehlkopfes; (vi) die Erkrankungen der Luftröhre und der Bronchien; (vii) Stimm- und Sprachstörungen; (viii) die Erkrankungen des Ohres; (ix) Innenohr und vegetatives Nervensystem; (x) Otoneurologie des Zentralnervensystems; (xi) die Vererbung in der Otolaryngologie. III. Die Bedeutung der Hals-Nasen-Ohrenheilkunde für die ärztliche Gutachterfähigkeit; Ohr und Schule; Hörapparate, soziale Fürsorge. (i) Hals-Nasen-Ohrenheilkunde und ärztliche Gutachterfähigkeit; (ii) Ohr und Schule (Schwerhörigenschule, Taubstummenanstalt); (iii) Hörapparate—soziale Fürsorge. IV. Rezeptsammlung. V. Sachregister. VI. Namenregister.

This swiss textbook must be welcomed as a notable modern treatise on the diseases of the mouth, throat, nose, larynx and ear. It is a first-rate textbook for students, and postgraduates and specialists too will find it a comprehensive work of reference. The importance of a background of general medicine is stressed throughout.

An excellent feature is an introduction on the taking of the case-history designed to disclose any condition which might give rise to ear, nose and throat symptoms. This is followed by a brief explanation of the meaning of the common ear, nose and throat symptoms and a clear outline of the special examinations; it seems unnecessary to show the Killian-Bruning endoscopes, while mentioning in the text that the distally illuminated tubes are extensively used.

The arrangement of subject-matter is excellent. The same plan is followed as far as possible in all diseases: etiology, pathology, diagnosis and treatment are discussed in turn. There are no descriptions of operations, since these are regarded as the province of specialists. The exceptions to this are very clear descriptions of laryngotomy and tracheotomy, and of intubation.

The *Mouth* is dealt with first; a feature here is the tabulation of the diseases due to hypovitaminosis and a description of the conditions due to poisoning with mercury, lead, gold, silver, arsenic and iodides.

The *Pharynx*: the tonsil and adenoid problem is discussed fully and very sound conclusions arrived at, which should be of great help to doctors. There is also a very good description of the various throat-affections consequent upon blood diseases.

The *Nose and Sinuses*: like all the rest, this section is full of highly practical advice. In the discussion on headache, extra-nasal causes are given as well as nasal, and the point made that if the application of cocaine to the middle turbinal diminishes the pain, the cause is probably in the nose or sinuses. Advice is given against the use of alum in the nose, as it has a specific toxic action on the olfactory nerve.

In dealing with epistaxis no mention is made of the recently-suggested ligation of the ethmoidal artery in uncontrolled cases. And there is no mention of calciferol in the treatment of lupus.

The *Larynx, Trachea and Bronchi*: all comprehensively dealt with; the diagrams of the cords and their paralyses are good. It is of interest to read that in 1.5% of thyroidectomies, paralysis of one recurrent nerve occurs, and that bilateral paralysis occurs during or after operation, "especially if one cord was paralyzed before operation by the thyroid swelling." The coloured plate of laryngeal diseases is not so good as others.

The *Ear*: this part has set a very high standard to any competitor. Not only are the descriptions of the anatomy and pathology admirable, but they are illustrated by many reproductions of microscopical appearances of sections of the temporal bone, of great value to the reader. Every complication of acute and chronic inflammation is described and explained; indeed, there is a wealth of practical information, both for student and expert.

Every aspect of deafness is considered. The section dealing with deaf-mutes is fully illustrated to show the method of teaching lip-reading, and concludes with advice on their treatment as human beings and the help that can be given them by clubs and social service.

Throughout the work, treatment by sulpha drugs and penicillin is advocated, but there is no mention of methods of administration nor of dosage, and even today dosage is not standardized.

This is one of the best textbooks, if not the best, of the present day on the diseases of the speciality; it contains a great store of information in a most readable form.

W. M. Mollison

of liver disease; (viii) infiltration of the liver and post-infiltrative fibrosis; (ix) parenchymatous hepatitis; (x) cholestasis; (xi) cholangitis; (xii) biliary ducts, and biliary diffuse hepatic fibrosis; (xiii) cholangiocarcinoma; (xiv) cancer of the liver; (xv) conclusions. Index.

Within the past ten to fifteen years certain facts in the pathology of the liver have assumed a major importance. These are: (i) the possibility of producing extensive and fatal hepatic necrosis in experimental animals by manipulation of the diet; (ii) the possibility of producing extreme fatty change in animals by similar means; (iii) that such fatty change may be a precedent incident in cirrhosis of the liver; (iv) that certain "lipotropic" substances will prevent or abolish such fatty infiltration. It is the endeavour of the author to bring together these various observations, and to unite them in a relatively-simple concordant theory of liver pathology.

His first postulate is that liver necrosis is essentially an ischaemia, due to swelling of liver cells and obliteration of the sinusoids; his next is that hepatic necrosis is essentially of two types, differing fundamentally: the one, a "massive necrosis" of irregular large areas of liver with no particular anatomical distribution (save that the left lobe is liable to suffer more than the right); and the other, a "zonal necrosis", i.e. an anatomically defined necrosis limited to lobules, affecting them all, but not confluent. This difference is pushed further into the chronic stage, or stage of partial recovery, so that the first lesion results in an irregularly scarred liver—"post necrotic scarring" (the nodular hyperplasia of other authors); and the second in a fibrosis destructive of lobular pattern—"diffuse hepatic fibrosis" (classical portal cirrhosis). These contentions are widely agreed, though the writer introduces a new terminology, but there is much that is new in the support of the argument by a large amount of experimental work, mainly, if not wholly, upon rats, which emphasizes with great clarity the distinction between the two pathological pictures. In this work Professor Himsworth was assisted by a pathological colleague, Dr. L. E. Glynn.

The results of this investigation show, broadly speaking, that the dietary deficiency which leads to massive liver necrosis is a lack of protein, and in particular the absence of the sulphur-containing amino-acids, methionine and cystine. It has frequently been observed that in acute necrosis of the liver the left lobe suffers more than the right and the ingenious explanation is put forward that as the right lobe receives principally blood from the small intestine, whereas the supply to the left lobe is largely admixed with blood from the splenic vein, it is to be expected that the former will receive amino-acids absorbed from the intestine in higher concentration, and thus suffer less when there is a specific deficiency of these in the diet. On the other hand, the lobular lesions which lead to a typical portal cirrhosis were found to be a sequel of gross and prolonged fatty infiltration of the liver; in the rats used for these experiments the fat content produced was between seven to fifteen times the normal, and this was maintained from 100 to 300 days, that is, for a period equivalent to about seven to twenty years of a man's lifetime. Such a condition is obviously an extreme one and it may legitimately be questioned how far such a result can be applied to explain the disease in man.

The experimental conditions producing this fatty change and subsequent fibrosis can also be shown to be dietetic, the condition being occasioned either by diets rich in fat, or by those deficient in "lipotropic" substances such as lecithine, choline, methionine and some others. In sum, the difference between these two forms of fibrosis and necrosis are: the massive form of the one and the lobular form of the other; the absence of notable fatty change in the one and its characteristic appearance in the other; the production of a fibrotic type of lesion, having the picture of nodular-type hyperplasia with large areas of regenerated liver in the one, and of portal cirrhosis, with an absence of recognizable liver lobules, in the other.

From this experimental and pathological study the author turns to human liver disease. It has long been known that fatty infiltration is a common feature of "alcoholic cirrhosis" but the exact relationship of the two conditions has been ill-understood. Professor Himsworth believes it to be a causal one, the liver cells, swollen by infiltrated fat, compressing the blood vessels and leading to a quiet disappearance of the liver parenchyma and an overgrowth of fibrous tissue, especially of the portal tracts. He further points out the high incidence of cirrhosis in certain coloured races in some parts of the world where alcohol is not apparently to blame and where dietary deficiency, especially

## PATHOLOGY

### 1261 Lectures on the Liver and its Diseases: Comprising the Lowell Lectures Delivered at Boston, Massachusetts, in March 1947

H. P. Himsworth. Oxford, Blackwell Scientific Publications, 1947. xiii + 204 pages; 58 figures. 23 x 15 cm. 18s. 6d. [£0.925]

(i) The types of liver injury and their structural consequences; (ii) the vascular factor in liver injury; (iii) nutritional factors in liver injury: experimental; (iv) nutritional factors in liver injury: human; (v) noxious factors causing liver injury; (vi) the syndromes of hepatic failure; (vii) the clinical classification



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in the rather expensive protein substances we have considered, is widespread. This is often particularly marked in infancy and young adult life in the poorer native races, and a good case is made out for a dietetic cause for this fibrosis; likewise the incidence of primary hepatic cancer—something of a rarity in Western Europe, and a well-known complication of liver fibrosis with regenerative areas—is instanced to support the same argument. Alcoholic cirrhosis is explained on the ground of the effect of chronic gastritis on appetite and food-absorption, and the predilection of the chronic alcoholic for spending his money on drink rather than upon the lipotropic factors which are so good for him.

The argument we have sketched in its broad outline occupies about half the book and is of the greatest interest. It is not too easy to read and suffers from a certain amount of reiteration. The rest of the book is devoted to a less penetrating analysis of other diseases of the liver, with a sharp eye to the main thesis. Hepatitis, the effects and action of poisons, and the various manifestations of hepatic failure are analyzed. There is a strange statement under the heading which includes fatty infiltration that "the infiltrating material is confined to the parenchymal cells where it presumably is formed" which must not be taken too literally, and a dreadful heresy that amyloid disease comes into the class of "conditions in which the liver cells are distended by some substance which accumulates in their cytoplasm".

Professor Himsforth has written an extremely well-documented and stimulating book. He sagely remarks that "The progress of knowledge can be as effectively impeded by a misconceived hypothesis as by factual ignorance"; time will show what place in the Valhalla of medical theories awaits those put forward in his book. Be this as it may, clinicians and pathologists will be grateful for the material here assembled and appreciate the tenacious investigation which has led to these conclusions.

J. H. Dible

## 1262 Pathological Histology

Robertson F. Ogilvie. Third Edition. Edinburgh, E. & S. Livingstone Ltd., 1947. xii + 459 pages; 260 illustrations. 22 x 14 cm. £1 17s. 6d. [£1.875]

(i) Disturbances of nutrition; (ii) disturbances of the circulation; (iii) inflammation and repair; (iv) specific inflammations; (v) tumours; (vi) tumours (continued); (vii) circulatory system: blood vessels; (viii) circulatory system: heart; (ix) respiratory system; (x) alimentary system: stomach and intestines; (xi) alimentary system: liver and gall bladder; pancreas; (xii) urinary system; (xiii) reproductive system; (xiv) haemopoietic system; (xv) nervous system; (xvi) integumentary system; (xvii) locomotor system; (xviii) endocrine system. Index.

This book is now established as a reliable guide to the practical study of pathological histology. It contains 260 beautifully executed photomicrographs in colour of the histological changes accompanying all the more common disease processes. The colour rendering is faithful and the choice of magnification and fields has obviously been carried out by a teacher of this subject of wide experience. Each illustration is accompanied by an adequate legend and the text of the book contains commendably brief and lucid general descriptions of each process illustrated.

The book can be recommended as the best possible substitute for a demonstrator of pathology to the student who is working through his own collection of sections, and should be most valuable in these days when classes tend to be overcrowded and skilled demonstrators "in short supply".

G. Hadfield

## 1263 Pathology of Tumours

R. A. Willis. London, Butterworth & Co. (Publishers), Ltd., 1948. xxiii + 992 + 52 pages; 500 illustrations. 25 x 17 cm. £3 3s. [£3.15]

Part I. (i) Definition of tumour; (ii) classification and nomenclature; (iii) innocence and malignancy; (iv) experimental production of tumours; (v) statistical study of tumours; (vi) tumours in animals; (vii) the mode of origin of tumours; (viii) structure and growth of tumours; (ix) the direct spread of tumours; (x) metastasis; (xi) hypotheses as to the nature of neoplasia; (xii) recapitulation. Part II. (xiii) Epithelial tumours of the breast; (xiv) epithelial tumours of the skin; (xv) epidermoid carcinomas of the lips, mouth, pharynx and larynx; (xvi) tumours derived from the epithelium of the dental lamina; (xvii) epithelial tumours of the salivary glands; (xviii) epithelial tumours of the nasal and paranasal cavities; (xix) epithelial tumours of the trachea, bronchi and lung; (xx) carcinoma of the oesophagus; (xxi) carcinoma of the stomach; (xxii) epithelial tumours of the small intestine; (xxiii) carcinoma of the large intestine; (xxiv) carcinoma of the liver; (xxv) epithelial tumours of the biliary tract; (xxvi) epithelial tumours of the pancreas; (xxvii) adenoma

and carcinoma of the kidney parenchyma; (xxviii) epithelial tumours of the urinary passages; (xxix) epithelial and related tumours of the ovary; (xxx) carcinoma of the Fallopian tube; (xxxi) epithelial tumours of the uterus; (xxxii) epithelial tumours of the vagina and vulva; (xxxiii) epithelial and related tumours of the testis and epididymis; (xxxiv) carcinoma of the prostate; (xxxv) epidermoid carcinoma of the penis and scrotum; (xxxvi) epithelial tumours of the thyroid gland; (xxxvii) epithelial tumours of the thymus; (xxxviii) epithelial pituitary and parapituitary tumours; (xxxix) tumours of the adrenal cortex; (xl) tumours of the parathyroid glands; (xli) introduction to mesenchymal tumours: fibroblastic tumours and myxomas; (xlii) tumours of adipose tissue; (xliii) tumours of cartilage and bone; (xliv) tumours of synovial tissue; (xlv) angiomas: tumours and tumour-like overgrowths of vascular tissue; (xlvi) meningioma or arachnoid fibroblastoma; (xlvii) leiomyoma and leiomyosarcoma; (xlviii) rhabdomyoma, rhabdomyosarcoma, and rhabdomyoblastic mixed tumours; (xlix) tumours of lymphoid tissue; (l) plasmacytomas and myelomatosis; (li) other neoplasms of haemopoietic tissues; (lii) the glioma; (liii) papillary tumours of the choroid plexus; (liv) neurilemmoma and other tumours of nerve-sheaths; (lv) neuroblastoma and ganglioneuroma; (lvi) tumours of chromaffin tissues and of the carotid and aortic bodies; (lvii) neuro-ectodermal tumours of the retina and ciliary body; (lviii) the melanomata; (lix) chordoma; (lx) embryonic tumours of kidney and liver; and general comments on embryonic tumours; (lxi) the teratomata; (lxii) chorion-epithelioma.

The need for a new, comprehensive textbook on the pathology of tumours has been felt for a long time by workers in this particular field as well as by morbid anatomists in general. Without doubt, the *Pathology of tumours* by Professor R. A. Willis will go a long way towards meeting this need. Admirers of his former writings, especially of *The spread of tumours in the human body*, will know that his interest has for long been focussed on tumour pathology. In this book of over 1,000 pages, he brings the experience of years to bear upon our present knowledge of tumour problems. Thus we are presented with an extraordinarily able summary of other workers' opinions and findings, together with Professor Willis' own views, more often than not formed as a result of personal investigation and expressed in no uncertain terms. In consequence, it is hardly likely that all the views expressed will be accepted without reserve.

One-fifth of the book is devoted to general considerations and this includes a helpful and up-to-date chapter on the experimental production of tumours, a vast subject at this present time. The other four-fifths, i.e., the main part of the book, are concerned with the pathology of tumours in various organs, and describe systematically: (a) the epithelial tumours of the breast, skin, digestive and respiratory organs, genito-urinary system and ductless glands; (b) the tumours of mesenchymal tissues, skeletal, myeloid and nervous. The incidence according to site, age, sex, race and species is discussed, as well as causative factors, structure, growth, metastasis, etc. The short references to tumours in animals and the descriptions of personally-observed representative cases are useful. There is a final section on the melanomata, chordoma, embryonic tumours, teratomata and chorion-epithelioma. Not a few of these subjects, for example the epithelial tumours of the skin, the teratomata and testicular and ovarian tumours, have been the special interest of Professor Willis for many years. In all cases, a critical summary of the work of other authors is presented, and at the end of each chapter is a comprehensive bibliography, in which those papers which have been found to be particularly helpful and instructive are listed in large, heavy type, and the full title included. This original and selective method is much to be commended. "Whatever omissions I may be guilty of in my reference lists, I can at least claim that they comprise works which, with very few exceptions, I have personally consulted in the original". The illustrations, mostly photomicrographs and numbering 500, are all from personally studied material. The standard of reproduction is very high and the legends particularly valuable. The selection is, perhaps, a little arbitrary; for example, there are 15 photomicrographs of fibro-adenoma of the breast and none of Brenner tumour of the ovary.

Many of Professor Willis' views will command agreement from most pathologists. For instance, the chapters on epithelial tumours of the testis and ovary are excellent and summarize current opinions fairly and clearly. Other of his opinions are less easily accepted. He would dispense completely with the term "endothelioma" and would classify tumours of mesenchymal tissues which happen to possess surfaces, with other tumours of mesenchymal origin. He supports entirely the epidermal origin of the melanomata; his main objection to a neural origin "is that these lesions are, as already insisted, plainly of epidermal origin". This does not seem to be a very cogent argument. He regards Paget's disease of the nipple as a form of epidermal carcinoma in situ, contrary to the views of Muir and others.

This is a book which no pathologist can afford to be without. It is a mine of up-to-date information, is most readable and is a model of accuracy and good sense. In addition, it contains that element of provocation which stimulates the reader to further thought and reading.

Georgiana M. Bonser

## PSYCHOLOGICAL MEDICINE

### 1264 Child Psychology

Arthur T. Jersild. Third Edition. London, Staples Press Limited, 1947. xi + 623 pages; figures. 21 x 14 cm. £1 10s. [£1.5]

(i) Beginnings of behavior; (ii) some general characteristics of development; (iii) some aspects of living and learning in infancy and early childhood; (iv) motor development; (v) development of social behavior; (vi) development of social behavior (*continued*); (vii) feeling and emotion; (viii) feeling and emotion (*continued*); (ix) language development; (x) the growth of understanding; (xi) growth of understanding (*continued*); (xii) children's make-believe, dreams, and other imaginative activities; (xiii) children's ideals, morals, and religion; (xiv) children's interests; (xv) the growth and prediction of intelligence; (xvi) personality and problems of adjustment. Author index. Subject index.

There is a pressing need for a good textbook on child-psychology; and, within the limits that he has set himself, Professor Jersild's book may be warmly recommended as a sound and scientific review of the subject. The third edition has been largely re-written. It incorporates all the latest American work of any importance, and appends excellent bibliographies on the chief topics at the end of each chapter.

Professor Jersild's primary purpose is to present a clear picture of the development of the child's personality. He is interested more in the emotional, moral, and social aspects than in problems of intellectual growth. The chapter on intelligence is comparatively brief; and the book makes no attempt to discuss in any detail the nature and maturation of special intellectual capacities, as assessed by psychological or educational tests or studied by factorial procedures. These topics, however, have already been fairly well covered in previous publications. On the other hand, there is at the moment no other book which succeeds so well in summarizing what is known about the development of feelings, interests, and ideals.

Professor Jersild adheres to no single school of thought; and his treatment is at once critical and eclectic. His tabular summaries giving the results of questionnaires and other inquiries upon such topics as children's games, commoner modes of enjoyment, range of worldly knowledge, and the like, at successive years of life, are most informative; they serve admirably to remind the student how essential it is to check hypotheses by objective data. Unfortunately, most of the summaries relate to investigations carried out in the USA. Hence, the inferences drawn may not always apply to children on this side of the Atlantic. The very words used to describe the children's favourite games will be unfamiliar to many British readers. That, however, is almost unavoidable, since few researches of this type have been carried out on any extensive scale in Britain. It is to be hoped that this English issue of the book will stimulate British psychologists and research-workers to institute similar inquiries.

### 1265 The Shaping of Psychiatry by War

John Rawlings Rees. New York, W.W. Norton & Company, Inc., 1945. 158 pages. 21 x 14 cm. 10s. 6d. [£0.525]

(i) The frontiers extend; (ii) opportunities emerge; (iii) the way ahead. Appendix: The tasks of psychiatry. Index.

No one is better fitted than Dr. J. R. Rees to describe how British psychiatry adapted itself to the calls made upon it by war, since he was Consulting Psychiatrist to the British Army from 1939 to 1945 and was responsible for most of the organization of army psychiatry during this time.

In this book, which is in substance the Thomas Williams Salmon memorial lectures given by Dr. Rees to the New York Academy of Medicine, he gives a very clear explanation of how dullards in the Army tended to form a social-problem group until it was discovered that drafting them to the Pioneer Corps was both therapeutic for the men themselves and productive of effective units for the war effort. He tells us that war provides more opportunities for psychiatrists than for physicians, and that very

soon the man-power problem brought to the front the importance of selection. A Directorate of Personnel Selection was set up by the War Office under the Adjutant-General shortly after the Admiralty had started its own selection service for the Navy. The Royal Air Force, which had its flying crew selection at the start of the war, only later used selection methods for its ground staff.

For officer selection, which had previously been done by the "magic eye" technique, three group projection tests were developed which, with questionnaires and an intelligence test, formed the battery used for each candidate. Follow-up statistics showed the superiority of scientific techniques to the older methods in this type of selection also.

Dr. Rees says that morale can almost be defined as mental health and shows how low morale is associated with high sickness- and high delinquency-rates, including absence without leave. Nevertheless discipline cannot replace morale. He describes the value of films and radio talks in keeping up the spirits of soldiers long absent from home, and in discussing rehabilitation he shows how progress is resulting in a move away from the formal occupational therapy of recent times to individual care and welfare work and he instances what has been done for the blind, the partially sighted and the limbless.

He believes that the psychiatrist's work should be done not only in the out-patient department of a hospital but also in connexion with instability, social unrest, morale, and in advising modifications of working conditions, on welfare and on the use of leisure, on training and allocation, etc. In order that this can be done, procedures, tests and techniques will have to be worked out and adequate staffs provided, including psychologists, sociologists and statisticians. We are warned that malcontents and subversives will be called "communists" or worse unless we are able to demonstrate that they are men who have been unwisely handled and who are reacting like rebellious and difficult children. Dr. Rees also warns psychiatry against its internal difficulties, and its "old men," and says that it is too much dominated by clinical interests, by psychoses, and by local government.

The book is most stimulating and in these days of planning it is highly desirable that it should be read by all who may have responsibilities for organizing the future mental health services of the country. Quotations such as "Psychiatric thought must become part of the ordinary approach to his tasks of every worker in the field of health and human relations," and "Psychiatry must be planning in a strategic manner for the mental health of the future," indicate the breadth of the author's conception of the future of psychiatry. Just as Dr. Rees was one of the few who could have organized army psychiatry for the needs of war, so we shall have to rely on him to convince a wider public of the contribution which psychiatry can make to the health of the community in time of peace.

J. G. Hamilton

## PUBLIC HEALTH

### 1266 Handbook of Preventive Medicine (Air Ministry Publication 1269B)

Air Ministry. London, His Majesty's Stationery Office, 1946, reprinted 1947. vi + 213 pages; 42 illustrations. 23 x 15 cm. 7s. 6d. [£0.375]

(i) Personal hygiene; (ii) water; (iii) food and nutrition; (iv) environment; (v) conservancy; (vi) communicable diseases; (vii) disinfection and disinfection. Index.

A valuable and comprehensive survey of preventive medicine is contained within the 213 closely printed pages of this handbook published by the Air Ministry. The Royal Air Force have the deserved reputation of doing things well; their practice of hygiene is of high standard. One has been impressed not only in reading this book, but also from first-hand observation, by the ingenious practical ways devised by medical officers of the RAF in overcoming difficult problems of hygiene. Although, in conformity with service traditions, no names of authors are given, it is obvious from the pages of this handbook that the authorities responsible for it are masters of their job in theory and practice. One can detect that an effective "brains trust" has been busy, and apart from its own resources has had access to the best of current teaching. The hard experience gained through years of peace and combat, through scenes and conditions even more varied

than Greenland's icy mountains and India's coral strand, from the sub-stratosphere to the Libyan deserts, is reflected in these pages.

The excellent Chapter IV (Environment) contains sections on effects of heat and cold, hygiene and sanitation, heating of camps, lighting and ventilation, all of which are first-class. It is good that Bedford's charts on "effective comfort zones" have been reproduced. The illustrations are clear, but few readers, one fears, will study the many tables.

Minor points which the reviewer does not like so much include:

(i) The rather close type and the fact that it is difficult, with this style of binding, to read the end of the line on the left-hand page; this can be obviated to some extent by loosening the binding cord. (ii) Under the section of methods of dealing with head infestation it would be wise in a future edition to include methods using DDT and Gammexane, mentioned in a separate section, as well as the Lethane treatment prescribed. (iii) Not every authority would agree that for scabies it is "imperative" to have two treatments with benzyl benzoate. (iv) In the section on communicable diseases more direct statements regarding the source of infection in syphilis and gonorrhoea might be considered. (v) Most important of all, the subject of Health Education deserves a separate chapter. It is all important to gain the co-operation of every man and woman in the Forces, and a syllabus of talks, together with a description of modern methods of health education and the way of raising the ideas and ideals of service personnel, is very necessary. (vi) The chapter on personal hygiene might be enlarged and the instructions on tooth brushing extended to other aspects of personal hygiene. These are of the greatest importance to morale as well as to physical fitness.

At the price of three half-crowns this handbook is a marvel of cheapness, conciseness, and good teaching. Many public-health students, other than Service personnel, will gain the greatest benefit from its study.

J. L. Burn

## 1267 Recent Advances in Public Health

J. L. Burn. London, J. & A. Churchill Ltd., 1947. viii + 409 pages; 82 illustrations. 22 x 14 cm. £1 5s. [£1.25]

(i) Introductory. Public health and the individual: (ii) Public health nursing service; (iii) the care of mother and child; (iv) nursery care; (v) school health services; (vi) health education; (vii) mental health services; (viii) dental health services; (ix) medico-social services; (x) the handicapped child; (xi) the care of the family; (xii) welfare of the aged. Public health and the community: (xiii) Poverty and public health; (xiv) rehabilitation; (xv) health centres; (xvi) municipal food health services; (xvii) rural epidemiology; (xviii) airborne infections; (xix) diphtheria immunisation; (xx) methods of vaccination against smallpox; (xxi) tuberculosis; (xxii) venereal disease; (xxiii) scabies; (xxiv) verminous infestation; (xxv) municipal ambulance service; (xxvi) co-operation of voluntary and municipal agencies; (xxvii) international health relations. Public health and the environment: (xxviii) Smokeless air; (xxix) water purification; (xxx) swimming bath water; (xxxi) milk. High temperature short time method of pasteurisation; (xxxii) food substitutes; (xxxiii) Garbage system of refuse disposal; (xxxiv) home safety; (xxxv) road safety; (xxxvi) cremation; (xxxvii) garden cities.

This book is much more than a survey of progress in Public Health in Britain during the last few years. Rather it may be described as an outline of the best elements of current practice of the Health Departments of the major local authorities. It is, however, no formal exposition of administrative methods, for scientific progress towards prevention of disease is always related to the practice described.

Dr. Burn is an outstanding member of the younger school of medical officers of health who have long developed their interest in social affairs and have refused to be diverted by onerous administrative duties. It is amply clear from this book that the forebodings of so many health officers at losing their hospital work and many of the personal health services, under the National Health Service Act, are not fully justified. The vast majority of the subjects dealt with in this book are still in the particular, if not exclusive, province of the medical officers of health.

Over half the book is devoted to the health of children and their mothers—a proper proportion for any exposition of preventive medicine. For the rest, there are chapters on rural epidemiology, tuberculosis, prevention of infectious disease, and other subjects concerning which public health authorities are taking action for the benefit of the community. The chapters on the physical environment as influencing the health of the people are relatively short, a welcome realization of the extent to which the balance of public-health activity has swung away from sanitation. Nevertheless, it is strange in a book on public health not to find a chapter on housing. Perhaps because of the virtual

cessation of slum clearance due to the war, this subject of housing has passed into the background of the health officers' work. There is, of course, incidental reference to housing in many parts of the book and in a study confined to "recent advances" the author cannot cover every subject.

There is no other book which deals with these subjects from the point of view of a medical officer of health, so that reference will repeatedly be made to it by postgraduate students and practising health officers. It is therefore disappointing to find such an inadequate index. It is understood that the original index was much more comprehensive but that paper shortage finally determined a drastic reduction. This defect will no doubt be remedied in future editions.

Alan Carruth Stevenson

## 1268 Report of the County Medical Officer of Health and School Medical Officer for the Year 1946

London County Council. London, London County Council, 1947. 86 pages. 25 x 17 cm. 2s. [£0.1]

Annual reports of medical officers of health in this country are not on the whole very imaginative, nor are they light reading. Indeed, considering the care devoted to their preparation, and the masses of information, so significant to an understanding of social affairs which they contain, it is a great pity that the presentation is such as to deter the prospective reader. It must be said that this report of the County Medical Officer of Health of London is a good example of this tendency—packed with thought-provoking information but difficult, oh so difficult to read from cover to cover.

1946 was a very difficult year: a year of shortages of staff, particularly of nurses and hospital domestic workers; of work under difficult conditions in emergency or partly damaged buildings; and of housing shortages. During the year the population of the area of London County Council (L.C.C.) rose by 500,000 to 3,000,000, 75 % of the pre-war population, and this did not decrease problems of accommodation in houses, schools or hospitals.

In spite of all this, the work of the health department was further developed and new enterprises were launched in several directions. The County home-midwifery service was greatly extended and gas/air anaesthesia introduced in domiciliary midwifery practice. Even in the understaffed hospitals, the number of confinements increased above the pre-war figures. When so high a proportion of all confinements (probably about 50 %) are conducted by one or other council service, the health department is entitled to credit for their share in the low maternal mortality of 1.26 per 1000 live births. Only 0.33 per 1000 of the total is accounted to puerperal sepsis. These are the lowest figures ever recorded and compare favourably with those for the rest of England and Wales.

Infant mortality also fell to a new low level of 38 per 1000 live births, and child mortalities at all higher ages were also lower, mainly due to decrease in incidence and case mortality of whooping cough, measles and diphtheria.

This tale of reduction of mortalities in different groups and from specific causes could be continued indefinitely; certainly as far as statistical indices are considered the health of all London continued to improve.

One of the interesting developments of hospital work in London during the war was the much closer co-operation of the voluntary and the "L.C.C." hospitals. This showed itself not only in grouping of specialist facilities in units staffed jointly but in mutually advantageous arrangements for the teaching of nurses and medical students. The war-time association of teaching hospitals and council hospitals has been so advantageous as to be continued since the war and it is now to be perpetuated by an arrangement under the National Health Service. By this the special privileges accorded to the governing bodies of teaching hospitals is to be extended to include associated hospitals. This excellent arrangement will allow the London teaching hospitals to have properly balanced teaching material for the medical students and for the better all-round experience of nurses.

The School Medical Service of the London County Council is an enormous undertaking also controlled by the County Medical Officer and directed by a Principal Medical Officer. London is by far the largest unit of School Medical Service in the world (334,784 pupils in 1946), and that service is severely handicapped by the

dreadful old school buildings and medical inspection rooms which are still all too common. By delegation of authority to five divisional medical officers some of the disadvantages of unwieldy size are avoided. In two ways the London school medical work is unique: a high proportion of medical inspection and treatment is carried out by part-time practitioners, and most of the follow-up work (done by school nurses elsewhere) is the responsibility of voluntary care committees. These two differences can hardly fail to mitigate the "official" atmosphere inevitable to such a large undertaking. Perhaps the best vindication of the service lies not in the many tables showing reductions of incidence of this disease or that, but in the figure of 72.9% which is the proportion of routine inspections at which the child's parent was present in response to invitation.

Nearly half of all children have their midday meal in school and 93.14% of children in primary schools have one-third of a pint of milk free each day.

It is quite impossible to abstract further these eighty-three pages of closely packed information or even to mention the many activities of the London County Council special clinics, hospitals and schools. Perhaps enough has been said to convince a doctor interested in social medicine who is visiting London that he should try to see personally some of the activities of its Health Department.

A. C. Stevenson

## RADIOLOGY

### 1269 Certain Aspects of the Action of Radiation on Living Cells

*British Journal of Radiology*. London, British Institute of Radiology, 1947. (Supplement No. 1. Report of London Conference held May 13-14, 1946.) 146 pages; illustrations. 25 x 18 cm. 15s. 6d. [£0.775]

First Session: A. A brief survey of the physical processes involved in the absorption of radiation by living cells. B. The action of radiation on viruses. Second Session: The action of radiation on dilute aqueous solutions. Third Session: The action of radiation on chromosomes. Fourth Session: The effects of radiation on germ cells with special reference to man. Index.

The Editorial Board of the *British Journal of Radiology* is to be congratulated on its new departure—styled "Supplement No. 1"—which, in every way, adheres to the high standards of its parent journal. As its rather unwieldy title implies, the *Supplement* reports the proceedings of a two-day Conference held in May 1946, under the auspices of the British Institute of Radiology in London.

The mode of action of ionizing radiations was discussed by some 18 speakers, all men of eminence in their own spheres, who presented original papers on highly specialized subjects, covering the scientific hinterland of medicine. For this reason, the general medical reader may find the genetics and radiochemistry in this volume rather heavy going. However, there are at least two articles (on Viruses, by Dr. Roy Markham; and The Effect of Radiation on the Normal and Malignant Cell in Man, by Dr. P. C. Koller), which are of great general interest. The rest of the subjects are extremely important to radiologists, and especially to radiotherapists; and, of course, to those studying these special subjects, which I propose to review seriatim.

The Conference divided itself into five main headings. First, a comprehensive survey of the physics of radiation absorption: this is very well done and constitutes a summation of the advances of knowledge in this subject. After this, follow papers on the action of radiation in four special cases: Viruses; Dilute Aqueous Solutions; Chromosomes; and, finally, Germ Cells, with Special Reference to Man.

The section on viruses is of obvious importance in view of the role of viruses in the causation of tumours. It is interesting to note how we have advanced since the days when bacteriophages were the subject of controversy, and their discoverers subject to ridicule. Since that time, phages have been photographed with the electron microscope, and some have been shown to have a shape similar to a tadpole. Their discovery was made in England and France independently by Twort and d'Herelle. In the symposium under discussion are two papers by French workers on research done during the occupation of France. It was

gratifying to find good general agreement on parallel work conducted independently in the two countries.

The section on Dilute Aqueous Solutions has important bearings for the radiotherapist, since every malignant cell is approximately 90% water; and advances in this subject throw much light on the indirect effects of radiotherapy. This is particularly true of the effects on enzyme solutions, and one feels that a little more emphasis might have been placed on Mitchell's work on the conversion of ribose into desoxyribose nucleic acid.

The third section is mainly concerned with chromosome breakage and interchange, and is of a very high standard indeed; to the radiotherapist, Dr. Koller's paper will have an especial appeal.

The final section, on The Effects of Radiation on Germ Cells, includes a discussion on the occupational hazards of radiology, with particular regard to the fertility of workers in this field. Laboratory work is mainly carried out on the smaller mammals and on various insects (*Drosophila*, *Habrobracon*, and the like), and conclusions drawn from these creatures are not necessarily valid for the larger mammalia. Fortunately, the rather alarming conjectures of the geneticists concerning sub-fertility have not, as yet, been borne out in the human race. We are reassured to read in the discussion which followed this section, that in rabbits (the largest mammals represented in the experimental animals) several normal generations have been bred from spermatozoa irradiated with 50 r to 100 r.

However, there remains a wide field of research in this direction, and a comprehensive survey of the size and number of congenital abnormalities, occurring in families of x-ray workers of all classes, would seem to be desirable: this is too large a subject to be dealt with in this review, as are most of the important questions raised in these papers.

The whole Supplement deserves the highest praise, both in format and content. It is a really important work—the best thing of its kind yet published. Every radiotherapist should buy, beg, borrow or steal this book, which fills an important gap in the literature of this difficult subject.

It is to be hoped that further Supplements will follow, and that they will be bound in the stiffer cover that they deserve. My own copy is already becoming well dog-eared from constant use.

Ronald Hadden

### 1270 Radium Dosage. The Manchester System

Edited by W. J. Meredith. Edinburgh, E. & S. Livingstone, Ltd., 1947. vii + 124 pages; 38 figures; 4 plates. 25 x 19 cm. 15s. [£0.75]

Part I. Clinical aspects. (i) General introduction; (ii) mould treatments; (iii) rules for line-source applicator treatments; (iv) rules for cylinder mould treatments; (v) interstitial treatments; (vi) dosage for cancer of cervix uteri. Part II. Physical aspects. (vii) The physical basis of the planar mould and line source systems; (viii) physical basis of the cylinder mould system; (ix) the radiation field of a continuous cylindrical applicator; (x) physical aspects of the interstitial treatments system; (xi) the calculation of dosage and an additional distribution rule for cylindrical "volume" implantations with radium; (xii) the use of radiographs for dosage control in interstitial gamma-ray therapy. References. Index. Appendix I, II.

The Radium Dosage system developed and used at the Christie Hospital and Holt Radium Institute, Manchester, has become firmly established and its wide use in this country provides forcible testimony of its value and reliability.

The present volume is really a collection of the various papers published from Manchester during the past thirteen years on the subject of radium dosage systems. An attempt has been made to link up the papers in such a way that a single dosage system has been elaborated to cover all three types of radium technique, i.e., mould, intracavitary, and interstitial. The book, like several of the original papers, is divided into two sections—Part I Clinical, and Part II Physical.

The first part is clearly and simply written and is devoid of formidable mathematical formulae. The well-known dosage tables and distribution rules are given for each technique described and a series of well-illustrated examples is furnished, based on the use of the National Radium Commission Standard types of radium container. The original dosage-graphs are in an appendix to the book and are given in the form of tables. Also included in the Appendix are useful tables concerning radon, areas and circumferences of circles and volumes of cylinders.



Part II of the book, on physical aspects, will appeal chiefly to physicists or radiotherapists fortunate enough to possess the requisite knowledge of mathematics.

The compilation of the book was a very bappy thought, as it makes available in compact form information which is of fundamental importance both to radiotherapists and others concerned with or in any way interested in radium therapy.

M. Lederman

## RHEUMATISM

### 1271 Rheumatism and Soft Tissue Injuries

James Cyriax. London, Hamish Hamilton Medical Books, 1947. 410 pages; 101 figures; 107 plates. 24 x 16 cm. £2 2s. [£2.1]

(i) Traumatic and rheumatic inflammation; (ii) referred pain; (iii) neuritis and perineuritis; (iv) the diagnosis of soft-tissue lesions; (v) the head, neck and scapular area; (vi) the shoulder region; (vii) the elbow, wrist and hand; (viii) thorax and abdominal wall; (ix) the alimentary tract; (x) diagnosis in backache; (xi) the treatment of backache; (xii) the sacro-iliac joint; (xiii) pain in the buttock and thigh; (xiv) the lumbar nerve-roots; (xv) the knee; (xvi) the leg, ankle and foot; (xvii) treatment by movement (1); (xviii) treatment by movement (2); (xix) anaesthesia and analgesia; (xx) functional pain; (xxi) the problem of rheumatism and non-specific arthritis; (xxii) doctor and physio-therapist. References. Index.

This book contains the author's views on soft tissue injuries and rheumatism. In spite of its name comparatively little consideration is devoted to the latter subject. Some of the views expressed are somewhat unorthodox and the pathological conceptions will be generally considered over-simple.

The technique of massage which is particularly associated with the author's name is well described, and the greater part of the book consists in an account of its application to the various parts of the body, which are classified topographically.

There are many good illustrations and the volume is beautifully produced. It is likely to be of more interest perhaps to specialist physicians and physiotherapists than to the rank and file, but it provides food for thought for all.

W. S. C. Copeman

## STERILITY

### 1272 Diagnosis in Sterility. The Proceedings of a Conference sponsored by the National Committee on Maternal Health, New York City

Edited by Earl T. Engle. Oxford, Blackwell Scientific Publications Ltd., 1947. xi + 237 pages; 43 illustrations. 23 x 15 cm. £1 5s. [£1.25]

(i) The semen specimen. Laboratory examination; (ii) clinical interpretation of the semen analysis; (iii) the testicular biopsy. A five-year survey; (iv) the role of the accessory glands in fertility; (v) chronic hemospermia. Origin of the bleeding and treatment with estrogen; (vi) diagnosing the endometrial biopsy; (vii) interpretation of the basal body temperature curves; (viii) interpretation of post-coital examinations of cervical mucus; (ix) history taking for the infertile couple; (x) an interpretation and evaluation of tubal patency tests; (xi) reflections on a working hypothesis concerning a mechanism of sterility; (xii) so-called "pelvic congestion" in relation to sterility; (xiii) summary of the conference.

The Proceedings of the Conference on problems of human fertility held under the auspices of the National Committee on Maternal Health, in January 1945, are presented in this volume.

Five papers on the male factors—the semen specimen (J. MacLeod), its clinical interpretation (F. A. Simmons), testicular biopsy (C. W. Charny), the role of the accessory glands in fertility (C. Huggins), and chronic haemospermia (D. F. McDonald)—were read and discussed. The seven papers on the female aspect were: endometrial biopsy and its diagnosis (A. T. Hertig), basal body temperature curves (P. Tomkins), the post-coital test (W. W. Williams), history taking for the subfertile couple (W. H. Cary), tubal patency tests (N. F. Miller), a working hypothesis of the mechanism of sterility (A. T. Kenyon) and "pelvic congestion" in relation to sterility (H. C. Taylor). Finally, one of the leading authorities on the subject—Dr. John Rock—gave a clear and succinct summary of the Conference. Three of the points from the various papers that he stressed were: the diagnosis of necrospermia is not usually a very important one,

the need for a larger series of examinations of actively-procreating men in order to crystallize the various reference points for the consideration of semen, and the need for tactful handling of the husbands as there is so little to be done about very defective males.

On the female side, Dr. Rock said he was far from being impressed by the various treatments suggested to produce ovulation among the 3 to 5 per cent. of women who come to sterility clinics and are found to be anovulatory. Of mittelschmerz, it was still uncertain whether it came during the enlargement of the follicle when the cortex is being stretched, or when the cortex breaks, or with the impact of bleeding on the peritoneum. Of certain of his own cases he says: "I have come to the point of offering exploratory operation to any couple whose mating has been infertile for five years, and in whom there is no demonstrable cause for sterility. I will try a few endocrines here and there for two to three months, while they are making up their minds, but I think there is a great field for careful surgery in these cases."

The above papers, each followed by free and thorough discussions, go to comprise this volume of the Proceedings, which covers the various aspects of the subfertility problem.

Since this meeting there have been two more recent conferences under the aegis of the American Society for the Study of Sterility in June 1947, and February 1948. At the former, research on bialuronidase, an enzyme of the mammalian testes and sperm, came prominently into the limelight. The Proceedings of the latter meeting have not yet been published, so that the degree of progress made since the 1945 Proceedings under review is difficult to assess, though there are many gaps in our present knowledge and much scope for research.

Cedric Lane Roberts

## SURGERY

### 1273 Surface and Radiological Anatomy for Students and General Practitioners

A. B. Appleton, W. J. Hamilton & Ivan C. C. Tchaperoff. Second Edition rewritten by A. B. Appleton, W. J. Hamilton & G. Simon. Cambridge, W. Heffer & Sons Limited, 1946. viii + 332 pages; 390 figures. 25 x 19 cm. £1 11s. 6d. [£1.575]

I. General Anatomy and Methods. II. The Upper Limb: (i) Shoulder and arm; (ii) elbow, forearm and hand; (iii) vessels and nerves. III. The Chest and Back: (iv) Thoracic wall; (v) thoracic contents; (vi) physical examination of the thorax; (vii) great vessels; (viii) oesophagus. IV. Abdomen: (ix) Abdominal wall; (x) physical examination of the abdomen; (xi) abdominal contents; (xii) perineum; (xiii) deep blood-vessels of the abdomen. V. Head and Neck: (xiv) General features; (xv) the neck; (xvi) special organs and regions; (xvii) vessels and nerves; (xviii) the brain and its associated vessels; (xix) radiology. VI. The Vertebral Column. VII. The Lower Limb: (xx) Buttock and thigh; (xxi) region of the knee; (xxii) leg and foot; (xxiii) vessels and nerves. Appendices. Index.

The second edition of this book, written by three distinguished teachers from one scottish and two London medical schools, offers a new and inspiring approach to the study of anatomy. The radiological exposition of the skeleton and internal structures presents anatomy from a new and curiously realistic viewpoint. The projection on the surface of the deeper structures and their relation to the bony landmarks of the living body are of particular value in applied and clinical anatomy. The work should be no less valuable to the anatomist than to the radiologist and the clinician. The body is treated systematically, and its formal anatomy is presented in a novel, striking, and eminently truthful way. Many of the diagrams are highly original and strike home the anatomical points which they illustrate in so dramatic a fashion, that anatomical statements which have, from too frequent repetition in purely anatomical works, lost to the student their freshness, regain life and interest. This is really three-dimensional anatomy.

The book will also be valuable to the radiologist as well as to the clinician or to the students of anatomy, for by anatomical exposition the radiologist, too, is reminded constantly that his study is a three-dimensional one, and that anatomical substance underlies the shadows on his film.

Ian Aird

## 1274 Ambulatory Proctology

Alfred J. Cantor. London, Hamish Hamilton Medical Books, 1946. xv + 524 pages; 281 figures. 24 x 16 cm. £2 2s. [£2.1]

(i) Clinical anatomy; (ii) diagnosis; (iii) anaesthesia and analgesia; (iv) pre-operative and postoperative management; (v) pediatric proctology; (vi) pruritus ani; (vii) cryptitis and papillitis; (viii) anorectal fistula; (ix) perianal and perirectal abscesses and infections; (x) anal ulcer; (xi) hemorrhoids; (xii) prolapse and proctitis; (xiii) colitis; (xiv) diagnostic methods; (xv) enterocolitis and colitis; (xvi) bacillary dysentery; (xvii) tuberculous; (xviii) lymphogranuloma venereum; (xix) venereal diseases; (xx) intestinal parasites; (xxi) constipation; (xxii) melanosis coli; (xxiii) diverticulosis and diverticulitis; (xxiv) benign tumours; (xxv) multiple adenoma; (xxvi) malignant neoplasms; (xxvii) pilonidal dimple, sinus, cyst, and abscess; (xxviii) coccygodynia; (xxix) rectal stricture and anal stenosis; (xxx) anal incontinence; (xxxi) foreign bodies and rectal trauma; (xxxii) electrosurgical techniques. Index.

It is curiously antithetical that in the USA where specialization is narrowing perhaps more rapidly than elsewhere, a book should be produced which seems to make a specialty more accessible to the general physician. At first sight it would seem that it is a pity to distinguish arbitrarily those diseases in any field which require hospitalization from those which do not. The volume must perhaps be regarded rather as an argued plea for the more frequent treatment of rectal diseases in the consulting room. It is precisely in this particular that the book will meet with some criticism from British proctologists. There are no doubt advantages to be gained from the ambulatory post-operative treatment of certain rectal conditions, since the erect posture certainly allows for a free drainage, but in illustrating extensive and complicated procedures such as the treatment of deep pararectal abscesses in a book with this title, the author is perhaps inclined to treat rather lightly a most distressing and recurrent variety of ill-health, and one in which an inadequate operation is almost certain to fail in its purpose. Even the operation of haemorrhoidectomy is fully considered and three methods are described for use presumably in the ambulant patient.

The therapeutic measures described in the volume are, however, considered in such detail that it makes one wish that the author had not restricted himself to the ambulatory branch of his specialty. Diagnostic methods, too, are dealt with in the most satisfying fashion and, as a guide to rectal diagnosis and a manual of minor treatment, the volume is well worth its place in the practitioner's library.

Ian Aird

## 1275 British Surgical Practice. Volume 1

Under the general editorship of Ernest Rock Carling & J. Paterson Ross. London, Butterworth & Co., Ltd., 1947. xxxi + 536 pages; 228 illustrations; 2 plates. 25 x 17 cm. £3

(i) Abdominal emergencies; (ii) abdominal pain; (iii) abdominal wall; (iv) abortion; (v) abscess; (vi) achlorhydria and appetite; (vii) acidosis; (viii) actinomycosis; (ix) adhesions and cicatricial stenoses; (x) adhesions (pleural) in pulmonary tuberculosis; (xi) adiposity; (xii) adrenal glands; (xiii) after-care—introduction; (xiv) after-care—follow-up; (xv) after-care—methods and value of massage; (xvi) after-care—on return home; (xvii) after-care—post-operative; (xviii) after-care—remedial and occupational therapy and rehabilitation; (xix) air passages; (xx) allergy; (xxi) amoebiasis—amoebic infection of intestine (pathology); (xxii) amoebiasis—amoebic infection of intestine (surgery); (xxiii) amoebiasis—liver abscess and pathology of amoebiasis other than intestinal; (xxiv) amputations; (xxv) amyloid infiltration (amyloidosis); (xxvi) anaesthesia—general; (xxvii) anaesthesia—local infiltration; (xxviii) anaesthesia—regional; (xxix) angina pectoris; (xxx) angina pectoris (management); (xxxi) anxiety states; (xxxii) appendix—tumours of; (xxxiii) arteries; (xxxiv) artificial pneumothorax; (xli) artificial pneumothorax; (xlii) aseptis and asepsis; (xliii) autonomic nervous system—introduction; (xliv) autonomic nervous system—anatomy; (xlv) autonomic nervous system—arteries. Index to Volume 1.

This work, which was begun during the difficult days of the war, has been awaited with eagerness and, if we are to judge by this first volume, will now be welcomed by many open bookcases. It is a first-rate presentation of modern British surgical practice. The names of the editors-in-chief are sufficient guarantee that the material is all up-to-date, accurate and well arranged, and a perusal of any or all of the articles confirms this view.

The arrangement of the articles is alphabetical and this volume deals only with the letter A, but in it are included many important and valuable contributions. The two sections dealing with the surgery of the arteries (by Learmonth & Telford), that on arthritis (by Norman Capener), and on appendicitis (by Nuttall) are outstanding contributions. Excellent too are the articles

on anaesthetics, on amputations and on aftercare. The last-mentioned subject is dealt with from every aspect by a group of experts. There is a short 6-page section by Dr. Lindsey Batten entitled "On return home" which particularly appealed to the reviewer as showing such sanity and common-sense as is too often absent in the rush of surgical work. We would recommend every young (and also older) surgeon to read and re-read this short section, for it may do his patients good.

The illustrations are excellent and help the text considerably. Sufficient references are given to point the reader to more extensive accounts of the subject under review.

The editors-in-chief have taken a wide view of the subject and have called in several physicians to help their surgical colleagues.

The index is elaborate and, if anything, errs somewhat on the side of profuseness, but that is in the right direction. However, we think a certain amount of valuable space is wasted in several instances by the long initial list of headings at the beginning of each article. Readers of this volume will have their appetites whetted for the future instalments of this comprehensive and valuable work.

V. Z. C.

## 1276 A Synopsis of Orthopaedic Surgery

A. David Le Vay. London, H. K. Lewis & Co. Ltd., 1947. vii + 242 pages; 55 illustrations. 23 x 16 cm. 15s. [£0.75]

(i) Systemic skeletal diseases; disorders of osteogenesis; (ii) systemic skeletal diseases; disorders of adult bone; (iii) local diseases of bone; (iv) local diseases of bone; (v) affections of joints; (vi) affections of joints; (vii) affections of joints; (viii) affections of joints; (ix) hip and disorders. Index.

Synopses in general have a limited appeal. There are many students who find difficulty in assimilating such a mass of concentrated facts. A synopsis of orthopaedic surgery, moreover, if wrongly directed and used is a potentially dangerous form of teaching; for in this specialty, perhaps more than in any other branch of surgery, a knowledge of the facts forms only a part of the necessary equipment. The development of a sound and balanced judgement in the choice of treatment and a knowledge of the imperative necessity for detailed supervision of after-treatment are of supreme importance. To accumulate a mass of facts from a synopsis while neglecting the development of such a balanced judgement, often leads to the knowledge being misapplied.

Mr. Le Vay is clearly well aware of these difficulties. In his preface he warns the reader that in assimilating the facts presented he must not lose sight of the necessity for considering each patient as an individual problem, to be individually assessed from every aspect, before deciding on a plan of treatment. His book is addressed only to the more senior undergraduate, and to the postgraduate student reading for the higher examinations. This is wisely so, for to read it with advantage the student must have already attained a reasonable standard of orthopaedic knowledge and should have had some experience in the orthopaedic wards and the out-patient department.

To those who fall into this category the book will undoubtedly prove of very great value. For its size it is remarkably complete, and right up to date. This is particularly noticeable in those sections dealing with some of the more difficult orthopaedic problems, closely studied and now properly understood only in comparatively recent times. Such conditions as sciatica and low back pain, costo-clavicular compression, prolapsed cervical disc, and peripheral nerve injuries have been dealt with in a well-balanced, logical manner. The conclusions and recommendations are generally in accord with the most enlightened modern opinion. Indeed, there is very little in the subject-matter which calls for criticism.

In discussing the treatment of congenital talipes equinovarus in infants perhaps more mention might have been made of the use of plaster of Paris as a method of maintaining the over-corrected position. There are many surgeons who cannot accept the dogmatic assertion that wasting of the calf muscles results only from immobilization by plaster of Paris. Again, in the discussion on severed flexor tendons within the digital sheath, more stress might have been laid on the desirability of avoiding suture of the tendon within the length of the fibrous sheath, and of using a long graft in order to place the suture-lines at the proximal and distal extremities of the sheath.

Illustrations have been avoided except where considered essential for clarity. Those included are in the form of simple line-drawings and are adequate for their purpose. That depicting the vertebral displacement in spondylolisthesis is misleading, for the fifth lumbar body is shown displaced forwards in relation to the fourth lumbar body as well as to the sacrum.

Except for the irritating frequency with which sentences are begun with a conjunction, and for an unwarranted looseness of terminology, such as the use of the word tubercle for tuberculosis, the style is easy to read; particularly so for a synopsis.

The author is to be congratulated on having produced a comprehensive and balanced summary of a relatively-new and constantly-advancing speciality in such a small compass.

H. Osmond-Clarke

## 1277 The Appendix

R. J. McNeill Love. London, H. K. Lewis & Co. Ltd., 1947. 186 pages; 54 illustrations. 19 x 12 cm. 12s. 6d. [£0.625]

(i) Historical; (ii) anatomy; (iii) aetiology; (iv) diagnosis; (v) differential diagnosis; (vi) treatment of the appendix mass, and general peritonitis; (vii) appendicectomy; (viii) post-operative complications; (ix) appendicostomy; (x) chronic appendicitis; (xi) less common diseases of the appendix; (xii) obstetrical and gynaecological considerations. Index.

Nearly every year sees some new book on the appendix published, and this is quite as it should be, for appendicitis accounts for more acute abdominal emergencies than all other causes put together, and advances in treatment are constantly being made.

This little book by a well-known surgical author is well produced and nicely written, and in a brief compass of twelve short chapters gives the essential facts as to the clinical symptoms, diagnosis and treatment of the various disorders of the vermiform appendix. We can recommend it as a sound presentation of present-day views, with that slight emphasis on the so-called "delayed" operative treatment which is perhaps needed as an antidote to the "immediate operation in every case" attitude.

We have little to criticize, but in two points we are not in complete agreement with the author. We have found that the triangle of hyperaesthesia in acute appendicitis is not like that in fig. 12 but has a horizontal upper limit at the level of the umbilicus; sometimes when the appendix has perforated the hyperaesthesia does not extend up so far. The second point is concerning the treatment of actinomycosis in the appendix region. The author states that "massive doses of penicillin are worthy of trial". We should go further than this and say that large doses of penicillin should be continued without intermission for several weeks at least. If this be done the actinomycotic mass will very likely gradually disappear completely. In any case there ought never be the need to perform any excision or short-circuit.

The author rightly points out that pseudo-myxoma of the peritoneum may be caused by a persisting perforation of the appendix; the reviewer vividly remembers a case in which a male patient presented himself with a large mass filling the pelvis and causing a supra-pubic tumour which simulated a distended bladder. This proved to be a large pseudo-myxomatous mass which had its origin in a chronic perforation of the vermiform appendix.

We should like to see a reference to Willard Parker in the first (historical) chapter, and we were sorry to see Ochsner's name spelt wrongly in six places.

The reader of this book will learn a few facts of general information, e.g. how the north american Indian wakes up a sleeping person, and why unmarried women sometimes ask to have their appendix removed.

V. Zachary Cope

## 1278 Chronic Structural Low Backache due to Low-back Structural Derangement

R. A. Roberts. London, H. K. Lewis & Co. Ltd., 1947. v + 105 pages; 46 plates. 25 x 19 cm. £2 5s. [£2.25]

(i) Defective ossification of the Pars Interarticularis; (ii) group A: cases of "spondylolisthesis"; (iii) group B: cases of "spondylolysis"; (iv) group C: cases of "unilateral spondylolysis"; (v) group D: cases with upper lumbar defects; (vi) group E: cases with radiological evidence of defects of ossification in the articular processes; (vii) group F: cases with various radiological changes; (viii) group G: cases with no definitely recognisable radiological changes; (ix) the significance of defects of ossification in the neural arch; (x) the significance of

the histories of chronic backaches; (xi) the significance of oedema in overstrained soft tissues; (xii) neuro-vascular and "visceral" symptoms; (xiii) low-back structural derangement; (xiv) treatment from the structural aspect; (xv) the medical profession and the chronic backache. Index.

Chronic structural low backache is, in this book, attributed mainly to abnormalities of the "pars interarticularis"—conditions known as spondylolysis and spondylolisthesis. It is suggested that these abnormalities are much more frequent than is generally appreciated. Many figures are quoted to support this view. Another reason given for failure to recognize these structural derangements is that frequently they are visible *only* in x-ray plates taken obliquely. An interesting contention is that these defects are not due to failure of fusion but to "deossification" as a result of chronic strain. The symptoms are attributed to the chronic strain, of which the structural derangement is a manifestation. Considerable importance is attached to oedema as a cause of localized pain in the back and also of root pain. Relief following saline injections—said by some to invite a psychological rather than a physical explanation of the pain—is due to dilution of oedema, aiding its more rapid absorption.

There is nothing strikingly new in this book—except perhaps some points regarding the cause and significance of the laminar defects. The author quotes other writers who have emphasized the frequency of these defects and also that oblique views are necessary to see them. To say the book contains nothing new is, in a way, a form of praise, as a better interpretation of much that is already known is urgently needed.

There are 137 figures, all x-ray plates, showing various abnormalities of the pars interarticularis; many of these are traced for ease of interpretation.

The last chapter—comprising one fifth of the text—is a general attack on the attitude of the profession to sufferers from backache, and a particular attack on psychiatrists for convincing ignorant "orthopaedists" and others to swell the ranks of those suffering from so-called psychosomatic disorders. This is excellent, the best part of the book and probably what justified its production. There are no half tones in this chapter. The medical officer (or specialist) painstaking enough to record physical signs and make a diagnosis of one of the many causes of backache, including those mentioned by the author, does not exist. All neuropsychiatrists are psychiatrists only and have heard of "anxiety state", but do not believe in physical signs in the diagnosis of disc lesions.

The book is interesting and stimulating. If it succeeds in making the profession as a whole more patient and interested in the considerable proportion of the population that suffers from backache it will serve a useful purpose.

J. C. Scott

## TOXICOLOGY

### 1279 Poisons, their Isolation and Identification

Frank Bamford. Second Edition, revised by C. P. Stewart. London, J. & A. Churchill Ltd., 1947. viii + 304 pages; 23 illustrations. 22 x 14 cm. £1 1s. [£1.05]

(i) Introduction: organization and equipment; (ii) classification of poisons; (iii) volatile poisons; (iv) volatile poisons (*continued*); (v) common metallic poisons; (vi) other metals; (vii) corrosive acids and alkalis; (viii) non-volatile organic poisons (alkaloids); (ix) non-basic organic poisons; (x) the isolation of non-volatile organic poisons; (xi) a systematic scheme for the identification of alkaloids; (xii) systematic testing for non-basic poisons; (xiii) miscellaneous poisons; (xiv) drugs of addiction. Index.

Soon after its publication in 1940, the first edition of this book had established itself as a reliable and most useful guide to the isolation and identification of poisons encountered in toxicological practice. The demands of chemists and clinical pathologists working in this field are exacting, methods must be described explicitly and must, above all, be of proven reliability. Bamford designed the volume as a practical handbook in which each test and procedure had been personally used in the examination of viscera for poisons and its ready acceptance as the standard british manual on the subject has indeed justified the high aims of the author.

In the second edition, under review, Dr. Stewart has faithfully preserved the book's outstanding characteristic. The text is little altered, the number of pages being indeed reduced by 40, but this is achieved by an addition of 5 more lines per page and the

exclusion of a separate author index. The short section on gaseous poisons is new and useful additional matter is noted under the quantitative determination of hydrocyanic acid, general procedures in toxicological analysis and under arsenic. A figure demonstrating the use of the Hartridge reversion spectroscope replaces that of the Duboscq colorimeter in the former edition. These are all improvements but, in the opinion of the reviewer, the value of the book has been enormously enhanced in this second edition by the judicious use of italics and sub-headings in bold type which facilitate quick reference and improve the general readability of the text. There is also evidence of careful trimming of several paragraphs with elimination of irrelevant matter, and the reviewer is glad to notice that the error in the chemical equation on p. 88 of the old edition has been perceived and corrected (p. 80).

Useful tabular rearrangement has been made of the barbiturates, and the section on the cardiac glycosides has been revised. The inclusion of notes on the preparation of reagents for alkaloid tests removes what was a blemish in the original work.

Altogether Dr. Stewart and the publishers are to be congratulated upon the high standard they have achieved and the book can be confidently recommended as essential on the shelves of any laboratory engaged in toxicological work.

C. Rimington

## TOXICITY OF METABOLITES

### 1280 Detoxication Mechanisms. The Metabolism of Drugs and Allied Organic Compounds

R. Tecwyn Williams. London, Chapman & Hall Ltd., 1947. viii + 288 pages. 22 x 14 cm. £1 5s. [£1.25]

(i) Introductory and historical; (ii) the metabolism of some aliphatic compounds and cyclohexane derivatives; (iii) the metabolism of aromatic hydrocarbons; (iv) the metabolism of halogenated aromatic hydrocarbons; (v) the metabolism of phenols; (vi) the metabolism of aromatic alcohols, ethers, aldehydes, ketones and amides; (vii) the metabolism of aromatic acids; (viii) the metabolism of organic cyanides; (ix) the metabolism of the aromatic nitro, amino and azo compounds; (x) the metabolism of sulphones, sulphonic acids and sulphonamides; (xi) the metabolism of terpenes and camphors; (xii) the metabolism of heterocyclic compounds; (xiii) the metabolism of organic compounds of arsenic; (xiv) theoretical considerations and conclusions. Bibliography. General Index.

It is unfortunate that, by the use of the title *Detoxication mechanisms*, Dr. Williams has given new life to a misnomer which showed some sign of dying a natural death. The sub-title of this book, "the metabolism of drugs and allied organic compounds", is at once a more satisfying terminology and a more true expression of the field covered by the author.

The aim of the author has been to summarize the literature over the whole field of drug metabolism for a period of just over one hundred years. The inevitable result is that the book, at times assumes the character of a catalogue, albeit a most useful catalogue. Perhaps Dr. Williams might have held more readily the attention of the general biochemical reader as opposed to the specialist in his own field if he had brought his last chapter, Theoretical Considerations and Conclusions, to the beginning of his book and had then attempted to relate the detailed findings on individual compounds to his theoretical background. There is no doubt that he is right in rejecting both the chemical defence hypothesis and the surface tension hypothesis as a working basis for further progress, but there is too little indication, in the main body of the book, that the general metabolic pattern of the animal body is the governing factor controlling the fate of all metabolites, either natural or foreign. Surprisingly little information is given about kidney function and, on the whole, one is left with the impression that the animal has been regarded by many workers as an interesting toy capable of chopping complex molecules into curious shapes. Such comment is not so much a reflection on this book as upon the existence of an artificial barrier between intermediary metabolism and drug metabolism which was erected over a period of years by the concept of specialized detoxication mechanisms. Dr. Williams might have done more to destroy this barrier.

These are the criticisms of a general reader who found several chapters of this small book of 250 pages rather heavy reading; they do not detract from the value of the book as a source of information which, within the limits set by the author, is concise, clear and reasonably complete. The book has brought together much scattered information and will be useful to the teacher or to the research student entering the field; it will also

save much searching of the literature by those workers who, without a detailed knowledge, suddenly find themselves faced with a problem in drug metabolism.

The book is provided with a general author index and a complete subject index which should make it a convenient source of reference. There are a few obvious printing errors and occasional formulae are badly printed or lack their full quota of bonds but on the whole the print is clear. It is unfortunate that the publishers should find it necessary to charge 25 shillings for a book of this size.

T. S. Work

## TUBERCULOSIS

### 1281 Dust and its Effects on the Respiratory System

George H. Gill. London, H. K. Lewis & Co. Ltd., 1947. viii + 50 pages; 17 illustrations. 22 x 14 cm. 5s. [£0.25]

With such a vast amount of published work on this subject, much of it indeterminate or equivocal, confronting the author, it must have been extremely difficult for him to choose what to include or what to omit. Mr. Gill has come down on one or other side of the fence on some debatable points, but that could hardly have been avoided in a condensed work of this nature.

The terms "Pneumokoniosis" and "Silicosis" are always a pitfall: pneumokoniosis embraces all forms of dust disease in the lungs and at whatever stage of the disease, silicosis is a subdivision applied to the disease resulting from exposure to silica dust. "Pneumokoniosis of coal miners" is another subdivision applied to the disease resulting from exposure to coal dust in which it is assumed, however, that silica plays a part. Pneumokoniosis is not an early stage of silicosis.

Possibly emphysema could be better described as a condition in which the lungs, their elastic, contractile power having been destroyed, become over-distended with unused or useless air. Here one is confronted by the author's own problem of compressing information, however.

Mr. Gill's reference to the electron microscope is timely; possibly this instrument would clarify the present unsatisfactory assessment of dust hazard in coal mines.

Altogether the author is to be congratulated for encompassing in a short summary so much well-selected, concise and pertinent information. For those, lay or medical, interested in dust disease this is an excellent "Primer".

E. Aslett

### 1282 Tuberkulöse Reinfektion beim Rinde und ihr Einfluss auf die Resistenz

E. Gräub, W. Zschokke, E. Saxer & H. Vonarburg. Basel, S. Karger, 1947. 82 pages; illustrations. 24 x 17 cm. Sw. fr. 12

(i) Einleitung; (ii) erste Versuchsperiode: 1932-1941; (iii) zweite Versuchsperiode: 1942-1947; (iv) Anhang.

Five calves subcutaneously infected with a bovine strain of attenuated virulence remained up to 4½ years resistant to subcutaneous infection with virulent strains. After subcutaneous infection with the avirulent bovine bacillus, a typical primary complex developed in three out of the five animals. One of the others showed bacilli only at the site of infection or in the regional lymph gland respectively. After virulent reinfection, however, a primary complex was found in one instance, whereas avirulent reinfection yielded only incomplete primary lesions, bacilli being recovered either from the site of reinfection or from a regional lymph node. After avirulent reinfection, latent tubercle bacilli were found in a lymph gland up to 24 months; after avirulent primary infection, up to 36 months at the site of infection. Repeated reinfection with a bovine strain of attenuated virulence proved a means of maintaining resistance to natural infection with virulent bacilli for years; (for example, 4 cows kept under observation for 4½-7½ years remained free of infection, in spite of immediate contact with tuberculous cows for 17-36 months). A local arrest of virulent bacilli at the site of reinfection could be demonstrated. They did not even reach the corresponding lymph glands. Animals infected with living avirulent bacilli became, as a rule, allergic and, although showing temporary fluctuation in the response, reacted to tuberculin—

the intradermal test being superior to the subcutaneous (thermo-) and optharmo-reaction. The subcutaneous test remains negative after spontaneous infection with human, avian and saprophytic acid-fast bacilli. A positive subcutaneous tuberculin reaction indicates infection with the bovine type. The subcutaneous reaction also depends upon natural or acquired resistance. With increasing resistance acquired by avirulent infection, tuberculin hypersensitivity vanishes, but may temporarily re-appear on the development of new active foci subsequent to avirulent reinfection. With regard to tuberculosis of the udder and infection of the milk, of the five calves infected with attenuated bacilli and reinfected in adult age, none developed chronic tuberculosis of the udder, at least within 4½ years, nor caused reinfection during pregnancy or lactation by any permanent excretion of tubercle bacilli through the milk, results which favour the conclusion that in infected cowsheds bacilli find their way into the milk after its excretion (for example, from infected faeces, vaginal mucus or infected straw-bedding).

The authors attribute the efficiency of avirulent infection, in inducing resistance, not only to the properties of the strain used, but also to their own *special technique*, consisting of repeated reinfection in *different areas involving ever-new groups of lymph glands*. If reinfections are always made in the same area the lymph glands already damaged by the first infection and previous reinfections will be unable to display their full tissue function in building up resistance (whatever this function may be).

An appendix deals with the question of the influence of pregnancy on reinfection. Out of four animals infected and reinfected with the avirulent strain, two were protected against virulent reinfection. The susceptibility of the two remaining animals is attributed to permanent excretion (during 1½ years) of *Brucella abortus* (Bang) with the milk, which predisposed the udder to infection—an observation which confirms the view of Roux, who regards *Brucella* infection as a general predisposition to udder-tuberculosis.

Finally, some experiments in guinea-pigs are reported which are supposed to show that avirulent infection, which leaves permanent changes at the site of infection, is superior in conferring resistance to virulent reinfection to those yielding none or only fugitive changes (as for example, with killed tubercle bacilli, "Antiphymatol", Friedmann bacilli and B.C.G. In this the authors fail to see that much depends here on the mode and frequency of application of the killed or avirulent bacilli, factors which they themselves have shown to be operative in their own experiments with cows, reported above.

W. Pagel

# PARTICULARS OF BOOKS REVIEWED ELSEWHERE IN THIS NUMBER

The numerals in square brackets  
are the serial numbers of the  
articles in which these books are  
reviewed

## [1210] Chemotherapeutic and Other Studies of Typhus

van den Ende, M. et al. London, His Majesty's Stationery Office, 1946. (Medical Research Council Special Report Series No. 255.) 246 pages; illustrations. 24 x 15 cm. 12s. 6d. [£0.625]

(i) The toxicity of two sulphonamides (VI47 and VI86) having activity against experimental typhus in mice; (ii) chemotherapeutic trials in typhus fever in man, and a report of the Naples typhus epidemic. A report of the British Army typhus research team; (iii) a quantitative test for neutralizing antibodies against typhus rickettsiae; (iv) comparison of typhus vaccines in the laboratory; (v) the antigenic structure of typhus rickettsiae. Appendix A: Illustrative case reports. Appendix B: List of drugs tested for chemotherapeutic activity against experimental typhus infection in mice.

## [1211] Dimensions of Personality

H. J. Eysenck. London, Kegan Paul, Trench, Trubner & Co., Ltd., 1947. xi + 308 pages. 22 figures. 22 x 14 cm. £1.5s. [£1.25]

(i) Methods and definitions; (ii) assessments and ratings; (iii) physique and constitution; (iv) ability and efficiency; (v) suggestibility and hypnosis; (vi) appreciation and expression; (vii) synthesis and conclusions. Appendices. Bibliography and author index. Subject index.

## [1213] Recherches Médicales en France Pendant la Guerre (1939-1945)

Jean Hamburger. [Paris], Editions Médicales Flammarion, 1947. 322 pages; illustrations. 25 x 16 cm.

## [1214] Estudios Sobre el Pulmon Colapsado

José Abelló Pascual. Madrid, Publicaciones del Patronato Nacional Antituberculoso, 1947. 506 pages; illustrations. 24.5 x 17.5 cm.

## [1214] Información sobre la Lucha Antitubercu- losa en España y Memoria Correspondiente al Año 1944

B. Benítez Franco. Madrid, Publicaciones del Patronato Nacional Antituberculoso, 1945. 366 pages; illustrations. 28 x 20 cm.

## [1214] Estudio de las Contralateralizaciones, especialmente Precoces, en los Procesos Pulmonares Tuberculosos de Apariencia Radiológica Unilateral

F. Tello-Valdivieso. Madrid, Publicaciones del Patronato Nacional Antituberculoso, 1946. 77 pages. 52 illustrations. 25 x 18 cm.

## [1214] La Tuberculosis Pulmonar Inadvertida y los Reconocimientos Radiológicos Seriadados

José Zapatero. Madrid, Publicaciones del Patronato Nacional Antituberculoso, 1946. 119 pages. 25 x 17 cm.

## [1214] La Lucha Antituberculosa en España

Madrid, Publicaciones Españolas. 40 pages. 50 illustrations. 22 x 19 cm. [no date]

## [1215] Tercer Congreso Interamericano de Cirugía. Montevideo, 1-6 Octubre de 1946. Tomo I: Relatos y Co-Relatos Oficiales

Edited by Fernando Etchegorry & Camilo Fabini. Montevideo, Talleres Gráficos de A. Monteverde, 1946. xiii + 527 pages; illustrations. 24 x 17 cm.

## [1215] Tercer Congreso Interamericano de Cirugía. Montevideo, 1-6 Octubre de 1946. Tomo II: Co-Relatos y Contribuciones a los Temas Oficiales

Edited by Fernando Etchegorry & Camilo Fabini. Montevideo, Talleres Gráficos de A. Monteverde, 1947. 582 pages; illustrations. 24 x 17 cm.

## [1215] Tercer Congreso Interamericano de Cirugía. Montevideo, 1-6 Octubre de 1946. Tomo III: Asamblea de Delegados, Temas Libres y Crónicas

Edited by Fernando Etchegorry & Camilo Fabini. Montevideo, Talleres Gráficos de A. Monteverde, 1947. 662 pages; illustrations. 24 x 17 cm.

## [1228] Wayfarers in Medicine

William Doolin. London, William Heinemann (Medical Books) Ltd., 1947. 284 pages; 39 illustrations. 22 x 14 cm. £1 ls. [£1.05]

(i) The oldest physician; (ii) the oldest textbook; (iii) *Græculi erudientes*; (iv) medicine and the trade routes; (v) a mediaeval surgeon and his book; (vi) Leonardo, the forerunner; (vii) in the days of Vesalius; (viii) the anatomist in art; (ix) a patient of the Renaissance; (x) Montaigne; (xi) "honest little Harvey"; (xii) Descartes, the link; (xiii) "plain Parson Hales"; (xiv) some old journeyman surgeons; (xv) some antique stones; (xvi) the evolution of surgery; (xvii) early Edinburgh surgeons; (xviii) a surgeon of France; (xix) the resurrection-men; (xx) wayfarers in Canada; (xxi) Laennec; (xxii) Claude Bernard; (xxiii) Lister; (xxiv) Osler; (xxv) Gorgas; (xxvi) Sir Robert Jones; (xxvii) pathfinders in Dublin. Envoi: and the future? Appendix: bibliographical notes. Index.

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## Shorter Notices

### Ocular Vertical Deviations

J. Ringland Anderson. London, British Journal of Ophthalmology, Ltd., 1947. Monograph Supplement XII. 108 pages; 37 illustrations. 25 x 17 cm. 12s. 6d. [£0.625]

The author, ophthalmic surgeon to the Royal Albert Hospital, Melbourne, includes in this monograph "a partial survey of the literature and an analysis of a series of 402 patients with horizontal and vertical defects of the concomitant and paralytic types." He gives an account of the action of the main ocular muscles as an essential basis for diagnosis and stresses the need for attention to the co-ordinated movements of both eyes together in arriving at an accurate diagnosis. In making this diagnosis he considers the study of diplopia a most useful guide. He regards the frequency of the occurrence of anomalies of the vertically acting muscles as much underestimated and notes the frequency of finding disorder of the vertical muscles in cases of "so-called concomitant strabismus."

Dr. Anderson's criterion for operative treatment is the disability resulting from an ocular palsy rather than the paresis itself, and he advises careful consideration of the possibility of spontaneous recovery. Although he does not attempt to describe the technique of orthoptic training, he suggests that it has an important position in the treatment of the majority of ocular palsies. He also gives concise accounts of various diagnostic tests (including a simplified routine for those not equipped with a Hess or projection apparatus) and short discussions of operative procedures.

P. W.

### Recent Advances in Medicine: Clinical, Laboratory, Therapeutic

G. E. Beaumont & E. C. Dodds. Twelfth edition. London, J. & A. Churchill Ltd., 1947. xii + 422 pages; 42 illustrations. 21 x 14 cm. £1 1s. [£1.05]

In this 12th edition of the *dayen* of the famous series, the authors have once again justified the title.

The chapter on chemotherapy has been rewritten and a new section added on synthetic antimalarial drugs. A new chapter has been added on the antibiotic substances, discussed both from the clinical and laboratory aspects. The chapter on vitamins has been considerably altered; in particular the sections on the vitamin B complex and vitamin K have been rewritten, and notes have been included on biotin, folic acid and dicoumarol. New articles deal with thiouracil, primary atypical pneumonia, infective hepatitis, homologous serum jaundice, bone marrow transfusion, the use of thiocyanates in the treatment of high blood pressure and the treatment of malignant disease by synthetic oestrogens. Chapter XIV, Blood and Urine Analysis, has been revised to include the latest procedures.

Unfortunately, in order to preserve the size of the volume certain sections, such as those dealing with the kidneys and diphtheria, have had to be omitted. However, such pruning is inevitable in a book of this kind if it is to retain one of its most useful features, namely ease of handling.

G. J. H.

### A Handbook of Midwifery for Pupil-Midwives, Midwives, and Obstetric Dressers

Comyns Berkeley. Thirteenth edition. London, Cassell & Company Ltd., 1946. ix + 456 pages; 88 illustrations. 19 x 12 cm. 12s. 6d. [£0.625]

Since 1906, this book, a standard work of its class, has passed through thirteen editions and twelve reprintings. While the book caters for the needs of those preparing for the examinations of the Central Midwives Board (for example, the chapter on hormones is in the present edition transferred to an appendix, as a result of the C.M.B. notification to examiners that pupil midwives need not be examined in this subject), it fulfils a wider function than that of an examination text. Authoritative answers are given to a wide range of problems, but, at the same time, clear and concise reasons are given for the validity of the answers.

The sections on treatment of unavoidable haemorrhage and on blood transfusion have been rewritten and a brief note on the Rh factor has been added.

A clear and full index adds to the value of the book.

P. W.

### Lunacy and Mental Deficiency. The Thirty-third Annual Report of the Board of Control for the Year 1946. Part I.

Board of Control. London, His Majesty's Stationery Office, 1947. 40 pages. 24 x 15 cm. 9d. [£0.0375]

Because of the changes which will result from the operation of the National Health Service which came into force in July 1948, this report is the last to be presented to Parliament in this form. The Board's administrative functions have now been transferred to the Ministry of Health.

The number of persons under care in 1946 was 146,444 and there were 6,009 more admissions during the year than in 1945. There has been a steady rise for several years in the number of admissions. Voluntary admissions (18,059) compare with 9,651 in 1938, and follow the development in both doctor and layman of a much greater awareness of the importance of early treatment.

There is an aggregate overcrowding rate of 13.1%; 15,170 beds were not available (10,417 being still diverted to wartime services, 3,080 unoccupied owing to shortage of staff, and 1,673 awaiting restoration or re-equipment). One of the most serious shortages is that of female nurses, but a slight improvement is evident in some hospitals.

It is a matter for satisfaction that, in the treatment of mental disorders, some form of physical treatment is used in every mental hospital to supplement psychotherapy and other methods. With regard to prefrontal leucotomy, some time must elapse before opinion can crystallize as to the efficacy of this form of treatment, but there is reason to hope that this operation offers a probability of relief and the possibility of recovery.

Emphasis is laid on the importance of occupational treatment for chronic patients. The shortage of social workers trained to undertake work in mental health is acute and the report suggests the need for a special course for training social workers for mental-deficiency services.

L. T. M.

### Diseases of the Nervous System

W. Russell Brain. Third edition. London, Geoffrey Cumberlege, Oxford University Press, 1947. xx + 987 pages; 80 illustrations. 22 x 14 cm. £1 17s. 6d. [£1.875]

During the fourteen years that have elapsed since the 1st edition of this book, it has earned for itself

## BOOK REVIEWS

Continued from page 409

### [1229] The Secret Instrument (The Birth of the Midwifery Forceps)

Walter Radcliffe. London, William Heinemann (Medical Books) Ltd., 1947. xvi + 83 pages; 23 illustrations. 19 x 13 cm. 10s. 6d. [£0.525]

(i) Prologue; (ii) mediaeval midwifery; (iii) the Chamberlen family; (iv) Hugh Chamberlen's secret; (v) the Dutch mystery; (vi) three Essex doctors; (vii) Mr. Smellie and Doctor "Slop"; (viii) the years of invention; (ix) the vectis. Bibliography. Appendix. Index.

### [1230] The Story of St. Thomas's 1106-1947

Charles Graves. London, Faber and Faber Ltd., for St. Thomas's Hospital, 1947. 72 pages; 41 illustrations; 8 plates. 24 x 16 cm. 8s. 6d. [£0.425]

(i) The religious foundation 1106-1540; (ii) the Royal Hospital 1553-1700; (iii) the early school of medicine 1700-1871; (iv) the birth of modern nursing 1871-1939; (v) the war and after 1940-1947.

### [1231] The Fever Bark Tree. The Pageant of Quinine

M. L. Duran-Reynals. London, W. H. Allen, 1947. 251 pages. 19 x 13 cm. 8s. 6d. [£0.425]

(i) Of fevers; (ii) the countess's powder; (iii) the Jesuits' powder; (iv) philosophical interlude; (v) the wonderful secret of the Englishman; (vi) the fever bark tree; (vii) the Botanical Institute of the New Kingdom of Granada; (viii) the breaking of the spell; (ix) scientific interlude; (x) poor man's quinine; (xi) the betrayal; (xii) rich man's quinine; (xiii) Hercules, the hydra, and the birds; (xiv) Bataan and Corregidor; (xv) of fevers.

### [1232] The Medical Writings of Anonymus Londinensis

W. H. S. Jones. Cambridge, Cambridge University Press, 1947. viii + 168 pages. 22 x 14 cm. 12s. 6d. [£0.625]

(i) Anonymi Londinensis Iatrica; (ii) Excursus I. The nature of Greek thought. II. The nature of Greek medicine. Index of *Notabilia*.

a position as the standard English work on neurology. Owing to the fact that seven war-years have passed since the 2nd edition, much revision has been necessary. The lessons of war have been no less in the neurological field than in others. New light has been thrown upon the nature of peripheral-nerve injuries and has entailed the rewriting of the relevant section. A new chapter is devoted to the nutritional disorders of the nervous system, based upon the unfortunate cases found in prisoner-of-war camps. Herniated lumbar intervertebral disk now occupies most of the space formerly devoted to sciatic neuritis. New sections have been added on equine encephalitis, myelopathy, the nervous complications of epidemic hepatitis, spinal radiculitis, and platybasia. The section on the psychological aspects of neurology has been recast and now includes the status of psychogenic symptoms, psychotherapy and psychometric tests. Like its predecessors, this edition is well supplied with illustrations and references, and the whole production is well up to the standard expected from this publisher.

G. J. H.

### Ulcer of the Stomach, Duodenum and Jejunum

Ralph C. Brown. New York, Oxford University Press; London, Geoffrey Cumberlege, 1946. iv + 104 pages; illustrations. 24 x 16 cm. 12s. 6d. [£0.625]

This book, reprinted from the Oxford Loose-Leaf Medicine, with pages similarly numbered, is a general review, on the lines of a text-book, of ulcer of the stomach, duodenum and jejunum. Sections are devoted to etiology, pathogenesis, morbid anatomy, symptoms, diagnosis and treatment. Gastric and duodenal ulcer are not clearly separated and often are dealt with together as peptic ulcer. Otherwise the statements are in general accord with the views held at the present time. A few cases are quoted briefly from the author's personal experience, and there are a few brief references to research by others. No new ground is broken. The figures, with the exception of the frontispiece, are contour-drawings from radiographs and illustrate clearly the well-known features of peptic ulcer.

Henry Tidy

### Traumatología Ocular de Urgencia

José Casanovas. Barcelona, Ediciones BYP, 1947. (Colección Española de Monografías Médicas, Volume 67-68.) 147 pages; 20 illustrations. 20 x 14 cm.

Dr. Casanovas, who is a member of the Faculty of Medicine in Barcelona, has written this short book to help medical men who are not specialists in ophthalmology but who may be required to give emergency treatment for eye injuries. The author begins by describing methods and apparatus for the examination of the eyes and for the location of injuries and foreign bodies in the eyes. Further chapters describe various eye injuries and their treatment. This book also includes Vol. 67-68 of the *Colección española de monografías médicas*, containing two original papers and reprints of five articles originally published in other journals.

V. E. C. M.

### Symptoms and Signs in Clinical Medicine: an Introduction to Medical Diagnosis

E. Noble Chamberlain. Fourth edition. Bristol, John Wright & Sons Ltd., 1947. vii + 463 pages; 346 figures. 23 x 15 cm. £1 10s. [£1.5]

We welcome the 4th edition of this book, which first appeared in 1936, and which is very widely used by medical students beginning their work in the

wards. Dr. Noble Chamberlain surveys a vast ground in this introduction to medical diagnosis. The main chapters of the book cover the clinical examination of the patient and the methods of taking a history and of eliciting physical signs, and briefly discuss the differential diagnosis of the abnormal signs. This part provides a clear account of the basic essentials of clinical medicine. The later chapters of the book, which deal with subsidiary methods of investigation, medical operations, radiology and clinical pathology, bear little relation to the title, are too condensed and lacking in detail for the enquiring student, and are more open to criticism. The directions for some of the operations, such as bronchography, while given in some detail, are in fact incomplete. Fig. 287, showing a black-coated doctor performing a lumbar puncture on a sitting patient, watched by an unmasked attendant, should surely be excluded from an introductory volume for the student; and lipiodol is now rarely, if ever, used intrathecally in the localization of spinal tumours.

It seems a pity that these chapters take up space which might profitably be filled by an expansion of the earlier part of the book. A fuller discussion of the causation of some of the physical signs would be of great value, and several sections require revision. A more complete account is needed of the eye signs in thyrotoxicosis, distinguishing clearly between exophthalmos and lid retraction; the section on the diagnosis of diseases of the liver is inadequate (and infective hepatitis is not mentioned as a cause of hepatic enlargement); and a coloured plate of the common skin rashes should surely appear in a volume devoted to physical signs. Since the introduction of chemotherapy, the student will rarely see a case of lobar pneumonia in which the "fever and constitutional signs continue . . . for a week, and the pyrexia then subsides by crisis", and he will find it difficult to appreciate how alkalosis, by causing relaxation of the hypertonic stomach wall, can lead to a correct adaptation between the stomach and its contents, with the relief of gastric pain.

It might, at first sight, appear invidious to criticize a work which, by its popularity, has proved that it fills a need, but the more widely used a textbook, the more important it is that it should be as free from fault as possible.

M. L. Rosenheim

### The Sanitary Inspector's Handbook: A Manual for Sanitary Inspectors and other Public Health Officers

Henry H. Clay. Sixth edition. London, H. K. Lewis & Co. Ltd., 1947. xxii + 545 pages; 99 illustrations. 22 x 14 cm. £1 2s. [£1.1]

The range of knowledge required by modern sanitary inspectors is very wide and this book provides an excellent guide to the many facets of their work. The great increase in legislation and regulations dealing with public health, as well as the advances in the technology of hygiene and sanitation that have taken place since the previous edition, has entailed a thorough revision and the addition of a considerable amount of new material. This book serves two valuable purposes: it is the essential textbook for the prospective sanitary inspector and an invaluable work of reference in public health departments. The illustrations, many of which have been redrawn in this edition, are models of clarity and should be of much use to the student.

G. J. H.

### A Way of Life for the Handicapped Child: a New Approach to Cerebral Palsy

Elsie Collis. London, Faber & Faber Ltd., 1947. 183 pages; illustrations. 21 x 14 cm. 10s. 6d. [£0.525]

The handicapped child of this book is the victim of cerebral palsy; the author studied under Dr. W. M. Phelps in the USA and is the pioneer in Great Britain of his approach in the treatment of such children. The London County Council gave her every facility to carry out the treatment in one of their children's hospitals and this book embodies the results of a personal study of individual children over a four-year period. The opening chapters deal with etiology, types, signs and symptoms of cerebral palsy and the psychology of the child so afflicted. It is assumed that treatment should consist in training a different part of the brain to take over the function of the damaged areas and subsequent chapters deal with the control of specific movement, e.g. strengthening the abdominal and respiratory muscles, proceeding to voluntary attempts at head raising, correct sitting and trunk movements, and occupational therapy in which the application of trained movements to specific skill is stressed. It includes the activities of the normal child, such as sand games, playing with blocks, buttoning and unbuttoning, etc. There are many illustrations of mechanical aids and supports, such as chairs, tables and sliding boards, made to the author's own designs, together with examination charts and descriptions of physical exercises, with their accompanying music, for routine work.

The book concludes with an excellent summary of this new approach, emphasizing that children with cerebral palsy are not necessarily mentally defective and that, while there is as yet no known cure for the condition, with patience and understanding on the part of the therapist they may be trained to become normal and happy members of the community.

D. F. A.

### Health the Unknown: the Story of the Peckham Experiment

John Comerford. London, Hamish Hamilton, 1947. 144 pages. 19 x 13 cm. 7s. 6d. [£0.375]

Mr. Comerford tells in his preface how he read *The Peckham experiment* by Pearce & Crocker and resolved to write a simplified and shortened version for the non-scientific reader; his success has been uneven. Here and there unexplained scientific terms appear, simple popular "journalistic" alternates with polysyllabic passages and there are a good many intrusions of pseudo-philosophy, but on the whole the idea and the spirit of the Peckham Pioneer Health Centre are well caught and vividly if impressionistically presented. The book bubbles with uncritical enthusiasm which will irritate the scientific reader but is likely to achieve the author's intention of arousing the interest of the ordinary man and leading him on to further study of the subject.

Too often the opinions of the staff of the Centre are quoted as if they were the dogmatic statements of accepted authorities and there are places in which Mr. Comerford implies that the Centre itself is a final solution to social problems rather than a laboratory in which they can be studied, a claim which the staff themselves are wisely reluctant to make. Again, the author's sadly imperfect knowledge of British public-health and social-service work betrays him into belittling its actual success and its potentialities. Read with caution the book has real value but, unfortunately, it is designed to appeal to the less cautious class of reader.

John D. Kershaw

### Man and Animals: What They Eat and Why (A Manual of Nutrition)

Ben Dawes. London, Longmans, Green & Co., 1947. vii + 100 pages. 19 x 13 cm. 7s. 6d. [£0.375]

This is not, as might be imagined from the title, a work of a popular nature; for the author, Reader in Zoology at King's College, London, presupposes in the lay reader, for whom it is intended, a knowledge of chemistry and physics in relation to biology. It is an amplified excerpt from a projected large general work on animal biology and deals with the fundamental chemical and physical relations between the living animal and the food it eats. The subject-matter is divided into three sections, on protoplasm, on the nature of food, and on the uses of food. The author would seem to be somewhat over-optimistic in thinking that lay readers will have the patience and intelligence to master the necessary use of scientific terms and in hoping that it will serve "to increase an instructed public interest in the problem of why we eat what we do." It should however prove of value to students of biology, zoology and biochemistry and to research workers in the field of animal nutrition.

G. J. H.

### A Textbook of Dietetics

L. S. P. Davidson & Ion A. Anderson. Second edition. London, Hamish Hamilton Medical Books, 1947. xix + 517 pages; illustrated. 22 x 14 cm. £1 1s. [£1.05]

This book is directed mainly to the student and to the general practitioner and deals with the subject under three main headings: the physiology of nutrition, diet in periods of physiological stress, and dietetic treatment in established disease. The war-years have seen great developments in each of these branches and the modification of the text to include them has involved a not inconsiderable increase in its length.

In the section on the physiology of nutrition, the chapters on proteins and vitamins have needed the most revision; the former now includes an account of protein hydrolysates and the latter a discussion of the use of folic acid in macrocytic anaemia. In the second section a new chapter has been added on the treatment of starvation, a subject that came into prominence with the liberation of prisoners from the concentration and prisoner-of-war camps. A useful new chapter is the one on special feeding methods, which are dealt with in some detail. The section on the treatment of established diseases has been brought up to date by new articles on the use of globin insulin, on the dietetic treatment of peptic ulcer and on other topics. The final section which deals with tables, recipes and diet sheets, has been completely redrafted in the light of the most recent authoritative official figures. It also includes a new chapter on methods of carrying out dietetic surveys.

G. J. H.

### Essentials for Final Examinations in Medicine

John de Swiet. Third edition. London J. & A. Churchill Ltd., 1947. vi + 178 pages 19 x 12 cm. 9s. [£0.45]

This book, as the author explains in the preface to the 1st edition, is intended to aid the student in his last revision for "finals", and not to replace the standard text-books of medicine. It can only summarize for him the knowledge he should already have gained from them. In this edition new material has been introduced on penicillin, pellagra and related disorders, osteo-arthritis, chronic subdural haematoma and primary atypical pneumonia. An index has been added.

H. C.

### Food Poisoning: its Nature, History and Causation. Measures for its Prevention and Control

Elliot B. Dewberry. Second edition. London, Leonard Hill Ltd., 1947. xii + 246 pages; 58 illustrations. 22 x 14 cm. 17s. 6d. [£0.875]

Although the author of this book claims no originality for it, the 1st edition filled a gap in medical literature by presenting in one volume the fundamental facts relative to many kinds of food poisoning. Previously, in order to acquire this information an extensive search of many different sources was necessary. For those wishing to read more widely on any topic an extensive bibliography is appended to each chapter. This edition has been brought up to date by the addition of new material, including a chapter on staphylococcus food-poisoning, a type of illness which has been much to the fore in recent years. Interest is added to the text by photographs of some of the early investigators in this field. It is a pity, however, that the modern practice of carrying the illustrations to the edge of the page has been adopted, as this inevitably leads to their suffering damage under the extensive use that a work of this type is likely to get.

G. J. H.

### Propedéutica de Patología Circulatoria en las Profesiones

Domingo de Durán Arrom. Madrid, Ediciones Morata, 1947. 171 pages; 28 illustrations. 25 x 18 cm. 40 ptas.

Dr. Durán Arrom has published many works on cardiological subjects, of which he has made a special study. He here describes disorders of the heart and circulation caused by trauma, occupational diseases, or infection. He discusses preventive measures and questions of diagnosis, treatment and medico-social care. The book is clearly and simply written and well illustrated, and contains useful author- and subject-indexes.

V. E. C. M.

### Vital Statistics and Public Health Work in the Tropics, Including Supplement on the Genealogy of Vital Statistics

P. Granville Edge. London, Baillière, Tindall & Cox, 1947. xii + 268 pages. 22 x 14 cm. 15s. [£0.75]

The 2nd edition of this work consists of a 2nd impression of the original edition, complete with index, and with about 80 additional pages entitled "The genealogy of vital statistics". To those who have not yet seen the 1st edition of 1944 the reprint will be of value. It is primarily addressed to those interested in British tropical territories, but will be helpful to all who have to deal with problems of vital statistics in the tropics.

The new historical section, with its separate index, breaks new ground. It is not confined to the tropics, and sketches the whole development of vital statistics from the Babylonian to the British Empire. The author certainly succeeds in his purpose of showing that this science is "the lineal descendant of a really ancient family", but he does not attempt to relate its history to the social and economic conditions that produced it. The study is of necessity only a summary, and will provide the medical historian with much interesting material and many references.

D. T. Richnell

### Child Health and Development by Various Authors

Edited by Richard W. B. Ellis. London, J. & A. Churchill Ltd., 1947. viii + 364 pages; 49 illustrations. 22 x 14 cm. 18s. [£0.9]

Professor Ellis is to be congratulated on the panel of eminent specialists who have contributed to this symposium. The book is intended to counterbalance the "too-exclusive preoccupation with disease in childhood" during medical training, by emphasizing the importance of child health. It is anticipated that it will be of value also in the training of nurses, health visitors and social workers.

The book is divided into two parts: the first deals with the physical, emotional and intellectual development of the normal child, and the second with various social services and conditions relating to child health. The section on development covers various aspects from the ante-natal period to puberty, including antenatal and postnatal care, the development of the foetus, nutrition and feeding, the teeth, growth, intellectual and emotional development, and immunity. The section on social aspects covers genetics, mortality, infant welfare, school health-services, nursery schools, the educational system the care of the homeless, and juvenile courts. One appendix presents an exposition of blood groups and the rhesus series, while another gives a useful annotated list of voluntary organizations concerned with child health. The whole symposium very adequately fills a gap in medical literature and should prove a valuable handbook for doctors, nurses and lay workers.

G. J. H.

### Tuberculosis and Chest Disease for Nurses

G. S. Erwin. London, J. & A. Churchill Ltd., 1946. vii + 236 pages; 39 illustrations. 21 x 14 cm. 10s. 6d. [£0.525]

The title of this book by the Medical Superintendent of the Liverpool Sanatorium, Frodsham, must be read in its literal sense. It is designed to explain in suitable terms the etiology, pathology, diagnosis (both clinical and laboratory), treatment and complications of tuberculosis and of non-tubercular pulmonary disease. It is not a textbook of the nursing technique proper to these conditions but a book which aims at giving the nurse a better theoretical understanding of them, both to increase her own efficiency and to fit her to undertake the work of "a health educator and teacher".

Rather more than half the book is devoted to pulmonary tuberculosis. This section, in addition to the consideration of pulmonary tuberculosis as a disease, gives one chapter to the discussion of various factors such as marriage, pregnancy, age, inheritance and co-existent physical and mental disorders, in relation to pulmonary tuberculosis; a second to a review of the home and institutional managements of the disease; and a third to the public-health aspects of tuberculosis. This last chapter ends with a brief note on the control of tuberculosis amongst nurses themselves.

Part II of the book deals briefly with non-pulmonary tuberculosis and its treatment, medical, surgical and orthopaedic, while part III is devoted to non-tubercular pulmonary disease. In a short appendix the causes of haemoptysis and of pleural effusion are listed.

P. W.

### A Guide to Anatomy for Students of Physiotherapy and Electro-therapy, etc.

E. D. Ewart. Sixth edition. London, H. K. Lewis & Co. Ltd., 1947. xii + 318 pages; 119 illustrations. 22 x 14 cm. £1 5s. [£1.25]

This work, of which the 5th edition was published in 1943, first appeared in 1921, with the express intention of providing a handbook for students preparing for examinations in medical gymnastics and massage. Consideration of body-structures is therefore limited by the special needs of that section of students to which the book is addressed.

It is divided into five sections: osteology, the trunk, head and neck, upper limb and lower limb. The last four sections are preceded by a short introductory chapter in which the general structure of body parts is considered, and each section ends with notes on surface markings.

The new nomenclature has been introduced in this edition, and the illustrations, with which the book is generously provided, have been largely revised.

An appendix gives anatomical questions recently set in the examinations of the Chartered Society of Physiotherapy, of the Association of Occupational Therapists and of the Society of Radiographers. The book is attractively laid out and has a useful index.

P. W.

### Gardiner's Handbook of Skin Diseases

[F.] Gardiner. Fifth edition revised by John Kinnear. Edinburgh, E. & S. Livingstone Ltd., 1948. xv + 250 pages; 80 figures; 20 plates. 19 x 13 cm. 15s. [£0.75]

This useful little book is intended as a handbook for students, general practitioners and nurses and, as such, attempts to deal adequately with the common skin diseases and briefly with the rarer ones. The long interval since the appearance of the previous edition in 1939 has made extensive revision necessary and the whole book has been brought up to date in the light of recent advances, particularly on the therapeutic side. It now includes the most modern methods of treatment, such as BAL in exfoliative dermatitis, penicillin in staphylococcal infections, and sulphapyridine in dermatitis herpetiformis. The illustrations, in particular the coloured plates, are extremely good and are in keeping with the general quality of the production.

G. J. H.

### Current Therapies of Personality Disorders: the Proceedings of the Thirty-fourth Annual Meeting of the American Psychopathological Association, held in New York City, April, 1945

Edited by Bernard Glueck. London, William Heinemann Medical Books Ltd., 1946. 296 pages. 24 x 16 cm. 17s. 6d. [£0.875]

It was a happy idea to publish these Proceedings of the American Psychopathological Association. The Presidential Address contains some thought-provoking quotations, including one from the undelivered last speech of the late President Roosevelt: "Today we are faced with the pre-eminent fact that if civilization is to survive, we must cultivate the science of human relationships . . . which last phrase, Dr. Glueck suggests, might be regarded as being particularly addressed to psychiatrists."

There is an interesting paper by Elsie B. Kris on the use of electro-shock therapy at the Pilgrim

State Hospital. She starts her treatment with a rather higher voltage (90-100 volts) than that used in Britain but finds like the British that a much higher voltage is rarely necessary. Her statement that "Patients with marked hypertension have been found to stand a full course of treatment without any kind of embarrassment" is surprising, as patients with hypertension are regarded as unsuitable for this form of therapy by some doctors. This paper should be read in conjunction with two others: Pharmacological Therapies in Psychiatric Practice, and Public Health Aspects of Insulin and Other Shock Therapies. The three together form a useful review of the development and practice of shock therapy.

Many will agree with Professor T. V. Moore that in dealing with the problem child: "It is not necessary to scold and condemn in order to alter conduct. One waits and leads. There is no necessity of giving advice when advice will not be accepted." His attempts to develop the character of adolescents through the reading of suitable books should command attention. He claims that his treatment is of special value in the behaviour disorders of preadolescent and adolescent children.

Like most works of a composite character not all the papers have the same value, but most of them will repay careful reading and the whole work reflects a refreshingly practical outlook.

F. T.

### Pharmacology and Therapeutics

Originally written by Arthur R. Cushny. 13th edition by Arthur Grollman & Donald Slaughter. London, J. & A. Churchill Ltd., 1947. 868 pages; 74 illustrations. 23 x 14 cm. £2 5s. [£2.25]

Since the last edition of this book in 1940, one of the two former editors has died and the other resigned, so that this edition is in new hands. The new editors have had therefore the difficult task of incorporating the changes necessitated by the notable advances in this subject during the last seven years, and of preserving the character of the original work. They appear to have been successful in both aspects. The bias of this book is in favour of practical therapeutics, so some of the older material of a more experimental nature has been omitted from this edition. It is intended as a textbook rather than a compendium of pharmacological knowledge. Although an American work, it caters for the British reader by giving the British nomenclature as well as the American, in cases where practice in the two countries differs; it also lists *British Pharmacopoeia* preparations as well as those of *The Pharmacopoeia of the United States*. References are confined to those of a pioneer nature and to those which themselves include extensive bibliographies.

G. J. H.

### Hey Groves' Synopsis of Surgery

Edited by Cecil P. G. Wakeley. Thirteenth edition. Bristol, John Wright & Sons Ltd., 1947. viii + 637 pages. 19 x 13 cm. £1 5s. [£1.25]

During the 40 years that have elapsed since the first appearance of this book, many thousands of students must have carried it about with them in the wards and out-patient departments, as did the present editor, Sir Cecil Wakeley. The concise manner in which the whole range of surgical knowledge is presented is the key to its popularity, which has been sustained by the constant revision to which it has been subjected in each edition. Since the previous edition, two years have passed in which advances have been made in many branches

of surgery, and this edition has been thoroughly revised to include them. The sulphonamide group of drugs and penicillin now play a large part in surgical treatment; they are covered in this book not only in the sections dealing with the treatment of acute infections but also in a new chapter on chemotherapy. The numerous line-drawings add to its value as a teaching instrument, and the excellent index makes quick reference an easy matter.

G. J. H.

### Diseases of the Nose, Throat and Ear. A Handbook for Students and Practitioners

I. Simson Hall. Fourth edition. Edinburgh, E. & S. Livingstone Ltd., 1948. xii + 463 pages; 62 figures; 8 plates. 19 x 12 cm. 15s. [£0.75]

The format of the 4th edition of this useful guide remains essentially the same as that of the last one, in 1944. The most outstanding advances in otology of recent years are discussed, among them the use of the fenestration operation in otosclerosis, and the author has incorporated alterations in treatment that have become general since the introduction of penicillin.

H. C.

### Experimental Physiology for Medical Students

D. T. Harris. Fourth edition. London, J. & A. Churchill Ltd., 1947. xi + 299 pages; 257 figures; 1 plate. 26 x 16 cm. 18s. [£0.9]

The divergent techniques available for the performance of many laboratory exercises, and the fact that teachers tend to emphasize different aspects of the subject, do not facilitate the preparation of a generally satisfactory textbook of experimental physiology. Professor Harris has made a praiseworthy effort to cope with these difficulties in the 4th edition of his *Experimental physiology*, which sets forth clearly and concisely the usual class exercises for students for the second M.B. examination, with enough scope in methods and sufficient detail in description to satisfy the requirements of all laboratories. The exercises amply fulfil the needs of M.B. students or of students working for a pass B.Sc. degree, although too advanced for a conjoint student and just falling short of the requirements of the Honours B.Sc. student. Professor Harris' book shows clearly the effect of the trend, now operative over twenty years, to include mammalian and especially human experiments. Many of these are necessarily demonstrations. The electronic devices and schematic presentation of circuits may not be as intelligible to the present-day students as Professor Harris believes, but they serve the useful purpose of focussing attention on the practical advantages of such understanding. This textbook is a most valuable asset to any physiological laboratory.

E. F. McCarthy

### Insect Pests

W. Clunie Harvey & Harry Hill. Second edition. London, H. K. Lewis & Co. Ltd., 1947. xi + 347 pages; 27 figures. 19 x 13 cm. 14s. [£0.7]

This handbook was presumably written for the assistance of sanitary inspectors and other health officials of local authority health-departments. The authors have clearly had much experience in control of domestic insect pests and they give much sound advice on practical procedure and legal responsibility.

This new edition includes a fairly long section containing useful information about the new insecticide DDT. There is also a shorter account of "Gammexane", but this is ambiguous, for it overlooks the importance of basing recommendations on the gamma isomer content. There are some rather unnecessarily full sections on insecticides which have become more or less obsolete or undesirable, especially fumigants such as ortho-dichlorobenzene, heavy naphtha, and formalin.

The biological data are somewhat less satisfactory than the portions devoted to control methods and procedure. Most of the text-figures are very poor and provide little help in identification of the pests. Since the authors consider the scientific names of the insects to be worth including, they would have done well to check the spelling of several of them.

A new chapter is given in this edition devoted (somewhat incongruously) to "mosquitoes and moths" (i.e. clothes moths). This addition should be useful, since local health-departments often receive queries and complaints about these insects.

J. R. Busvine

### Practical Physiological Chemistry

Philip B. Hawk, Bernard L. Oser & William H. Summerson. Twelfth edition. London, J. & A. Churchill Ltd., 1947. xiv + 1323 pages; 329 figures; 5 plates. 23 x 15 cm. £2 10s. [£2.5]

This, the oldest of the American textbooks of physiological chemistry, was first published in 1907; the 11th edition appeared in 1937. Dr. Oser is now a co-author with Dr. Hawk; the third collaborator, Professor Summerson, is associate professor of biochemistry, Cornell University Medical College.

This edition has been largely rewritten and in spite of the exclusion of methods now obsolete or of minor importance, the inclusion of new matter has increased the bulk of the book by approximately a third. This new matter, to quote the preface, includes sections "... on the polarograph; on isotopes; on the sulfa drugs; on metabolic antagonists and antibiotics; on the Warburg tissue-slice procedure; on the theory and practice of photometric analysis; on the electrophoretic fractionation of the plasma proteins; on the composition of foods; and on the various vitamins whose importance has become recognized since the last edition ..."

P. W.

### Biology for Medical Students

C. C. Hentschel & W. R. Ivimey Cook. Fourth edition. London, Longmans, Green & Co., 1947. xii + 752 pages; 453 illustrations. 22 x 14 cm. £1 5s. [£1.25]

This is the 4th edition of a book which first appeared in 1932 and which has seen two new impressions of its 1st edition, two of its 2nd and three of its 3rd. Revision was deferred until the present edition, that is until the new form of the teaching of biology for medical students was settled. As the type for the book was completely destroyed in 1945, the illustrations have had to be redrawn.

The botanical chapters have been entirely rewritten, more space being devoted to plant physiology. Whilst less alteration was needed in those on zoology, a new chapter on bionomics has been included. In the view of the authors the alterations are so extensive that the new edition should be regarded as substantially a new book.

J. L.-J.

### Textbook of Histology for Medical Students

Evelyn E. Hewer. Fourth edition. London, William Heinemann Medical Books Ltd., 1947. viii + 407 pages; 393 figures. 24 x 17 cm. £1 1s. [£1.05]

The 3rd edition of this standard textbook of histology was reviewed in the *British Medical Bulletin*, 1944, 2, 129 (BMB 387/35). In the new edition a 3-page chapter has been added on the protective mechanism of the body: this lists the usual sources of entry of injurious substances into the body, the structures preventing such entry, and the methods by which the body deals with infection or damage to tissues. The author has also enlarged the sections on the reproductive organs and on the respiratory system.

The illustrations are black-and-white photomicrographs and semi-diagrammatic line-drawings. New photomicrographs have been added, and material of academic rather than practical interest deleted, so that the volume has been increased by only about 40 pages.

This textbook covers elementary histology for medical students; references to further work are sparse and lack details.

H. P.

### Food Inspection Notes: a Handbook for Students

H. Hill & E. Dodsworth. Second edition. London, H. K. Lewis & Co. Ltd., 1947. vii + 125 pages. 17 x 11 cm. 6s. [£0.3]

This small handbook, the 1st edition of which appeared in 1943, is prepared by two sanitary inspectors with the purpose of presenting in summarized form present-day knowledge of foods and their inspection, to meet the needs of public-health officials and students. The text of the new edition has been revised, amended where necessary and brought completely up to date. Although the legal aspects of the subject are not dealt with, the book should prove, within its limitations, especially useful to students preparing for examinations.

W. W. S.

### Illustrations of Regional Anatomy

E. B. Jamieson. Seventh edition. Edinburgh, E. & S. Livingstone Ltd., 1947. 320 plates. 21 x 16 cm. (In seven separate sections.) £3 15s. [£3.75]

These illustrations are based on the work of Dr. Jamieson as Demonstrator in the Anatomy Department of Edinburgh University. They were originally diagrams used to illustrate his lectures on regional anatomy, collected and published in book form at the request of undergraduates. Some of the figures are copies of blackboard diagrams, but most of them are the result of observation of actual specimens. In this new edition, in one plate, the original drawing has been altered; in others, alterations, generally in colour, have been made and pointer-legends have been corrected. Explanatory additions have been made in some of the foot-legends of the figures.

H. C.

### The Midwife's Text-Book of the Principles and Practice of Midwifery

R. W. Johnstone. Third edition. London, Adam & Charles Black, 1947. viii + 398 pages; 205 illustrations. 22 x 14 cm. 18s. [£0.9]

Clarity, readability and a high standard of illustration are the hallmarks of this book, of which the 1st edition appeared in 1944 and the 2nd in 1946. There has been a general revision of the text for this edition, and a discussion of nitrous oxide and air analgesia has been added to the chapter devoted to drugs and solutions in common use. A new chapter on the Rh factor and its importance in midwifery has been included.

P. W.

### Supplement to the Catalogue of Lewis's Medical, Scientific and Technical Lending Library: Including a Classified Index of Subjects with the Names of those Authors who have Treated Upon Them. Supplement, 1944-1946

H. K. Lewis. London, Lewis's Library, 1947. iv + 175 pages. 22 x 14 cm. 5s. [£0.25] (To subscribers to the library, 2s. 6d.)

The present supplement is a useful guide to recent accessions to Lewis's Library, and to readers abroad will form an invaluable reference work to medical and scientific books published in Britain and the USA during 1944-46. American volumes are easily identified, as places of publication have been included; moreover, the prices of British works are quoted in sterling. No other single publication contains the same information, and books can be traced otherwise only by tedious search through such serial publications as the *Quarterly Cumulative Index Medicus* book lists or the technical books supplements issued with *Nature*.

F. T.

### An Introduction to Gastro-Enterology. A Clinical Study of the Structure and Functions of the Human Alimentary Tube

James Dunlop Lickley. Bristol, John Wright & Sons Ltd., 1947. viii + 143 pages; 21 illustrations. 19 x 13 cm. 8s. 6d. [£0.425]

This work is, from its length, obviously intended only as a general reminder of some of the problems involved in diagnosis and treatment of gastro-intestinal disorders. It is addressed to senior medical students, younger physicians and medical men returning from the armed forces. It is divided into four parts, on structure, function, abnormal conditions, and practical clinical applications.

D. T. Richnell

### Praktikum der Physiologischen Chemie

H. Lieb. Graz, Jos. A. Kienreich, 1946. 215 pages; 19 figures. 20 x 14 cm.

The author is the Director of the Medico-Chemical Institute of the University of Graz. The book is based on lectures accompanying practical exercises at the Institute and is intended primarily for students. The author has, however, expanded the book by the inclusion of several clinical methods of analysis in the hope that it may also be of use to doctors engaged in clinical work. Each chapter consists of short general remarks on the chemical nature of the substances to be tested, followed by a simple and lucid description of the tests themselves. The more important quantitative methods of analysis are given in an appendix.

W. M. G.



**Nothing New Under the Sun**

J. P. Lockhart-Mummery. London, Andrew Melrose Ltd. [1947] x + 178 pages; illustrations. 22 x 14 cm. 12s. 6d. [£0.625]

The contents of this book, which consists of a collection of essays, are aptly summed up by its title and by the Herrick quotation at the beginning of the preface—"Nothing is new; we walk where others went." In many of his essays, which have arresting titles, the author demonstrates that man, being an essentially imitative animal, has observed and exploited the phenomena of Nature for his own purposes.

The essays are not confined solely to medical subjects, but diverge widely, ranging from an account of the skill in the art of advertisement exhibited in the animal and vegetable kingdoms in relation to our own familiar commercial boostings, to a description of the force of the eruption of Krakatoa, as compared with the too well-known atomic-bomb explosions in Hiroshima, Nagasaki and the Bikini Atoll.

Such subjects as abnormalities of growth, diet and allergy are encountered in essays of medical interest. There are also references to quacks and charlatans, among them being Cagliostro, and Graham of the "celestial bed" fame. History is represented by, amongst other things, a description of water-supply through the ages, and an account of the development of architecture, from primitive hut-dwellings to the use of ferro-concrete and steel girders in modern building construction. The last essay, called *Science on Trial*, is an attempt to assess dispassionately the effect of man's application of scientific discovery, with its potentialities for good and evil, on economic and social structure of the past, present and future.

*Nothing new under the sun* is written throughout in a simple, unconventional style, and as the author says in the preface, is intended to afford interest and amusement to its readers, whose enjoyment will no doubt be increased by William Wood's delightful illustrations.

S. M. S.

**Spanish-English Medical Dictionary**

Maurice McElligott. London, H. K. Lewis & Co. Ltd., 1946. viii + 250 pages. 17 x 11 cm. 12s. 6d. [£0.625]

It is apparent that the compiler of this small dictionary has taken considerable trouble to ensure the accuracy of the 14,000 Spanish words listed and their English equivalents. He has, however, omitted to include a great many of the less ordinary terms and these lacunae seriously impair its usefulness, especially to translators. The author asks in his preface that users should inform him of omissions which they may observe, and which he hopes to include in future editions. The value of the dictionary would be further increased if explanations and examples of the use of words listed were given. It would nevertheless prove useful to those who use the dictionary in conjunction with works of reference, or in order to check spellings. The orthography of the English equivalents is that of *The Oxford English Dictionary*. It is hoped to follow up this dictionary with a companion volume of English-Spanish medical terms.

V. E. C. M.

**Practical Food Inspection. Volume I. Meat Inspection**

C. R. A. Martin. Third edition. London, H. K. Lewis & Co. Ltd., 1947. vii + 316 pages; 138 figures. 22 x 14 cm. 18s. [£0.9]

Intending sanitary inspectors will welcome a new edition of "Martin", but it could be read with

profit by others, particularly medical officers of health. Medical men will probably find the chapters on such diseases as tuberculosis, which occur in both animals and man, of greatest interest.

The work is eminently practical and a mine of information on how to arrive at a "diagnosis" in doubtful cases, e.g., anthrax. A "judgment" is appended to the description of each disease and is particularly useful in such a condition as hydatid cyst, where the destruction of the carcass is not practised as a routine. As the practical nature of the book is stressed it is rather surprising to find no reference to "lumpy jaw" as a synonym for actinomycosis of the jaw bones, either in the text or in the helpful glossary of terms.

The author has illustrated his work with line drawings, but some of these might be omitted, e.g., fig. 71, *Tubercle bacilli*. It would increase the value of the book to public-health workers if the various Acts and Memoranda referred to in the text were included in the index, somewhat after the style of *Clay's Sanitary Inspector's handbook*.

In conclusion, the author presents what at first sight is a dull subject in an interesting manner.

F. T.

**Panchito y el Mosco Anopheles**

México. Secretaría de Salubridad y Asistencia, Dirección General de Educación Higiénica, México, Secretaría de Salubridad y Asistencia, Dirección General de Educación Higiénica. 7 pages; 6 illustrations. 19 x 15 cm.

This booklet explains to children in a very simple and pleasant way the dangers of malaria, its symptoms and signs, the advisability of consulting the doctor in the early stages, the measures to be taken to protect oneself against mosquitoes—in short, it gives a broad outline of the disease and the remedy. The illustrations are good, both amusing and convincing. Any propaganda directed to children has a repercussion in home life, especially in that of poor peasants who were themselves unable to attend school in their childhood, and who regard their children as a source of wisdom and hope and wish to give them a better chance of life than they had themselves. This booklet probably aims at such results and is a good example of indirect propaganda.

M. V. L.

**The Essentials of Materia Medica, Pharmacology and Therapeutics**

R. H. Micks. Fourth edition. London, J. & A. Churchill Ltd., 1947. x + 399 pages. 21 x 14 cm. 18s. [£0.9]

"Micks" is probably the most popular, and certainly the most readable of the smaller books on its subject. The present edition has been extensively revised, and all the more familiar newer preparations that one would expect to find have their place. Yet a proper balance is maintained throughout the work. Penicillin occupies nearly a chapter, for example, but streptomycin is dealt with in a few restrained paragraphs as befits a drug whose proper value is not yet known. Special attention has been directed to anaesthetic drugs, and the section on curare alkaloids is adequate. Thiouracil, and its place in the treatment of hyperthyroidism, forms a useful introduction to the use of this drug. One notes with satisfaction that calciferol is discussed in connection with lupus.

It is sometimes said of the present work that it does not contain enough or that some drugs are excluded that should be included. This is not the fault of the author. The first words of the title are

"The essentials", and opinions are bound to differ as to what should be included under this heading. To quote from the preface: "Two aims have been kept in sight throughout the revision, the exposition of the principles which govern the action of therapeutically important drugs . . ." Therefore it is no use searching the index for information on drugs only used for diagnostic purposes such as iodoxy or pheniodol, even though these are included in similar books on materia medica.

"Micks" is the best introduction to its subject, though in view of what has already been said, prospective examinees should supplement it by reference to other works for some drugs, for example, urethane, which is so useful in the treatment of myeloid leukaemia, but is not to be found in the present edition. The author might consider the inclusion of benadryl in the index when the book is reprinted, especially as it is well described in the text (pp. 188-189).

F. T.

**Gas and Air Analgesia**

R. J. Minnitt. Third edition. London, Baillière, Tindall & Cox, 1947. vii + 80 pages; 19 illustrations. 18 x 12 cm. 5s. [£0.25]

This little work deals with a big subject, the alleviation of the pains of women in labour by the gas-air analgesia of which the author was one of the pioneers. The apparatus and its assembly, and the technique of its use in midwifery, are briefly but adequately described. Contraindications, causes of failure, applications to minor surgery, and statistics and legislative developments complete the scope of the book. No reference is made to any possible psychic after-effects such as have been described by Dr. Helene Deutsch in the USA.

F. T.

**¡ Salud, Madre Campesina !**

Esperanza Peña Monterrubio. México, Imprenta "GAMMA", 1941. 21 pages; illustrations. 23 x 21 cm.

In the rural areas of Mexico, whose population seems to be the audience aimed at by the present author, analphabetism is only one of many minor evils. It has long been recognized by experts on social and health propaganda that in such instances posters and illustrations are the best way to convey ideas of behaviour to men and women unable to understand the written word. The author has grasped very aptly the love of music of the Mexican countryfolk and has included in this booklet the music of a local tune to which a not very happy litany of health rules is to be sung. The illustrations are not convincing, there being no action explained in any of them except in perhaps two cases: the lazy drunken youth and the hard-working teetotaler. As for the text, although it is advisedly written in very plain and direct language to suit the level of intelligence ascribed to the intended readers, we fail to see why it should be so ungrammatical in a supposedly educational booklet.

In the text, a mother gives advice to her growing daughter concerning both her sexual life, and the dangers of alcoholism and venereal disease in her future husband, which might mar the happiness of their children. She also suggests ways to alleviate the primitive conditions of life in their mud-built dwellings ("jacalitos")—the sad scarcity of water, the absence of drainage or sanitation, in short, some of the many misfortunes associated with a poverty-stricken rural area anywhere in the world.

No official authority seems to have sponsored the publication of this booklet.

M. V. L.

**Good Health with Diabetes**

Ian Murray & Margaret B. Muir. Edinburgh, E. & S. Livingstone Ltd., 1947. vii + 40 pages. 18 x 12 cm. 2s. [£0.1]

The purpose of the authors (Physician and Sister-Dietician, Victoria Infirmary, Glasgow) is to provide in the briefest possible form the essential information required by the diabetic patient. In content, price, and format the booklet is suitable to place in the hands of patients themselves. Alternatively, it can be used by the physician as a framework for verbal guidance. The diets have been adjusted to present-day possibilities, and this is, perhaps, the justification for the production of a new work in a field that has already been fairly well covered.

D. T. Richnell

**Epidemia Regional de Malaria en la Cuenca del Lago de Maracaibo, 1942-1943. XII Conferencia Sanitaria Panamericana. No. 23**

M. Nieto Caicedo. Caracas, Editorial Grafolit, 1946. xx + 288 pages; illustrations. 24 x 16 cm.

Dr. Nieto Caicedo is attached to the malarialogical division of the Ministry of Health in Venezuela and in this book gives a very full account of the malaria epidemic of 1942-43 in the Lago de Maracaibo district. The first section of the book describes the population of this district, its geographical and climatic characteristics and the distribution of anopheles throughout the area. Section II gives data relating to the epidemic, which lasted for five months and was preceded by exceptionally heavy rainfall. Statistical tables show the numbers of people affected in different towns and districts. Section III relates the anti-epidemic measures adopted, which included the free distribution of quinine tablets, anopheles control, and press and radio educational propaganda. It is hoped that this book will be of interest and use to malarialogists who may be called upon to combat a similar epidemic.

V. E. C. M.

**Old people**

Nuffield Foundation. Report of a Survey Committee on the Problems of Ageing and the Care of Old People, under the Chairmanship of B. Seebahn Rowntree. London, Geoffrey Cumberlege, Oxford University Press, 1947. vii + 202 pages; illustrations. 21 x 14 cm. 3s. 6d. [£0.175]

Though the problem of extreme and unrelieved poverty in old age has largely been met, there remain many hardships of which the available evidence is too often disjointed and scattered. The work of the Nuffield Committee is therefore highly valuable for its collection and presentation of facts. It included in its survey men over 65 and women over 60. It studied their incomes, their living conditions, the institutions provided for their care, their amusements and their possible capacity for work.

The Committee recognized the bardship of loneliness of old age and the evil consequences for old people, living alone, when mentally or physically they may be unfit to care for themselves. It hoped for a solution of the problem in the provision of special homes which should avoid any suggestion of "institutional" atmosphere. Attention was given also to the potential value of old people's clubs. The Committee further gave considerable attention to employment for the aged, not only as a contribution to national prosperity, but as a means of retarding senility. Its recommendations, based on the survey, deserve the closest attention.

A Medical Sub-Committee reported on schemes of research, either begun or projected, into the process

of ageing. It suggested that there should not be any centralization of this work, but that the programme might be co-ordinated by the Medical Sub-Committee or similar body, which would advise on fellowships and grants in support of independent workers or teams of workers attacking special problems.

The report has 15 appendices giving information on present-day provision for the aged, on the conditions of life of certain selected groups and on the form of questions asked by the field-workers in carrying out the survey.

P. W.

**A Synopsis of Hygiene. (Jameson and Parkinson)**

G. S. Parkinson. Ninth edition. London, J. & A. Churchill Ltd., 1947. viii + 791 pages; 16 illustrations. 22 x 14 cm. £1 8s. [£1.4]

The fact that a book has run through many editions is sufficient evidence that it is meeting a need. This is undoubtedly so with "Jameson and Parkinson", which now reaches its 9th edition, for it has established itself as the textbook for students preparing for the Diploma in Public Health. Sir Wilson Jameson and Lt.-Col. Parkinson were for a dozen years in charge of the teaching for this examination at the London School of Hygiene and Tropical Medicine and were thus in the best possible position to know the needs of students. The 1st edition, by Jameson and Marchant, published in 1920, was a slim volume of only 404 pages. In the 2nd (1927) to 6th (1939) editions, by Jameson and Parkinson, it grew steadily to 687 pages, and the further two editions, by Parkinson alone, have brought it up to very nearly twice the size of the 1st. The assistance of Miss Kathleen M. Shaw, which is acknowledged in the prefaces from the 5th edition onwards, now receives full and well-deserved recognition on the title-page.

In this latest edition we miss the section on personal hygiene by Professor G. P. Crowden, which had been a feature of the 4th to 8th editions. Indeed, the subject as such appears to have been dropped from the book altogether and there is no reference to it in the index. About a third of Professor Crowden's chapter, dealing with nutrition, does however now appear in Section IV, though this fact is not mentioned either in the preface or the text. The increase of 72 pages over the previous edition is due to new legislation (Education Act 1944, National Health Service Act 1946, National Insurance Act, 1946); to new topics, such as the insecticide DDT; and to fuller treatment of many topics, e.g., food poisoning, occupational diseases and hygiene, and hospitals. Appendix V, containing the full text of the new rules for the Diploma in Public Health which came into operation on 1 January 1946, is a very handy feature for the student.

References to the literature are not very numerous and statements such as "Gray in 1928 found paratyphoid bacilli in seven out of twenty specimens . . . and Begbie and Gibson in 1930 found the same organism in seven out of fifty-seven specimens . . ." are occasionally made without any reference at all being given. The method of scattering bibliographic citations throughout the text not only distracts the eye of the reader but makes it very difficult to pick out a particular reference when one is consulting the book for this purpose. When, as happens in many cases, a long string of references is given at once, it is not always clear which author belongs to which title, etc. These are minor faults, but attention to them in future editions would ease the task of those who use this book as a work of reference.

Cyril C. Barnard

**Blood Pressure and its Disorders Including Angina Pectoris**

John Plesch. Second edition. London, Ballière, Tindall & Cox, 1947. xiv + 307 pages; 125 illustrations. 22 x 14 cm. £1 1s. [£1.05]

The author starts out with the most laudable intentions, namely, to restrict "the scope of the book to those matters of which I have personal experience through research and observation", and to refrain "from 'rehashing' what can be found in any standard work". Bearing these statements in mind, and the fact that he was formerly Professor of Internal Medicine in the University of Berlin, it is not surprising to find that the book has many references to foreign literature, and is written in a dogmatic, yet conversational style. New references and case-histories have been added in this edition, and the author is at his best when describing symptoms. Some readers will think that the importance of rest in angina pectoris is insufficiently stressed, and that overmuch space is given to smoking, in what the author admits is an "unconventional discussion." The diet chart of foods "permitted" in angina makes nostalgic reading in these days of worldwide shortages. There are too few monographs on the subject of blood-pressure disorders, and this one should prove a useful addition to the literature of the subject.

F. I.

**The Rhesus Factor**

G. Fulton Roberts. London, William Heinemann Medical Books Ltd., 1947. vii + 47 pages. 18 x 12 cm. 3s. 6d. [£0.175]

The development of research on blood transfusion, stimulated by the discovery of the rhesus factor in 1939 and by the Second World War, has led to discoveries of prime importance to all concerned with the diagnosis and treatment of haemolytic disease. It is the purpose of this booklet by Dr. Roberts, Medical Officer to the North-East London Blood Supply Depot, to acquaint the clinician with the elements and less controversial aspects of the subject. The social implications both of blood transfusion and of disease due to the Rh factor are such that the layman is bound to recognize their significance for himself. This account, therefore, may well prove of interest to readers other than medical men.

Dr. Roberts states that he has a propaganda purpose: "Since . . . every test . . . employs some serum from a patient who has at some time been immunised . . . it behoves every clinician to co-operate in obtaining such sera. Nearly all patients who have been sensitised are in a condition to spare 100 c.c. or more of their blood before the antibody titre falls." *Verb. sap.*

D. T. Richnell

**Zählrohrmethoden im medizinischen Forschungslaboratorium**

F. Roeder & R. Reiter. Göttingen, Vandenhoeck & Ruprecht, 1947. 35 pages; 15 illustrations. 21 x 15 cm.

In this booklet of 35 pages the authors intended to set out the elementary principles of the construction and operation of Geiger-Müller counters and of the necessary electronic circuits (amplifiers, quench-circuit, thyatron scaling circuit). It was meant for the use of technicians and assistants in biological and medical laboratories and therefore the emphasis throughout is on practical matters, although the technical details given seem hardly sufficient to enable the uninitiated to construct his

or her own Geiger-counter. There is no mention of the bell-shaped end-window type of counter which is so extensively used both in the USA and in Great Britain, especially in connexion with the biological application of radioactive isotopes. Because of the particular purpose of the booklet one would have liked to be given practical examples of actual radioactive assays also, especially of isotopes with weak energy radiations, and a fuller discussion of problems of sample mounting. The usefulness of this publication seems very limited indeed, compared with some American publications of recent years. Biologists would welcome a concise account of problems of radioactive assay; unfortunately this pamphlet does not fulfil the task of providing sufficient instruction, either practical or theoretical.

G. Popják

### Common Skin Diseases

A. C. Roxburgh. Eighth edition. London, H. K. Lewis & Co. Ltd., 1947. xxi + 497 pages; 213 illustrations; 8 plates. 22 x 14 cm. £1 ls. [£1.05]

The problem of what constitutes a "common" skin disease can never be finally settled, and the author has justifiably added a number of further conditions to his new edition. It has also been brought up to date by the inclusion of recent experiences with sulphonamides, penicillin and DDT in dermatology. Most welcome is the recognition accorded to the promising treatment of lupus vulgaris with calciferol. The chapter on varicose veins, eczema and ulcer has been re-written and new illustrations have been added. Beyond recording these improvements there is no need to commend this invaluable work to the general practitioner. The standard of production is well maintained, and if one wishes for further coloured plates, this is only a tribute to a work that deserves them. The author himself offers his apology for the necessary increase in price.

D. T. Richnell

### The Childbearing Years

G. Scott Russell. Oxford, Blackwell Scientific Publications, 1947. vii + 88 pages; 11 figures. 22 x 14 cm. 7s. 6d. [£0.375]

This book was written by the author because he felt that young women need a book about themselves, which they can read and digest at leisure and in the seclusion of the home, and which can help them to live fuller and more interesting lives. It is written primarily for those between the ages of seventeen and thirty, but the author adds that parents, teachers and others may find it both interesting and of value.

There is no doubt that this book is a valuable addition to the literature dealing with various aspects of reproduction. It differs from many of its predecessors in that it gives much more anatomical detail as well as a good deal of information about various abnormalities which may arise during the childbearing years. For this reason it is not suitable to be put into the hands of every young woman between the ages of seventeen and thirty, but should only be given to those who have the educational background to understand what they read, and in particular, who are able to place the knowledge they acquire of abnormality in its true perspective. The same remarks apply to the use of this book by parents and teachers, although to a less extent.

Provided the limitations of its use are thoroughly understood this book can be recommended.

J. M. M.

### Cerebro-Spinal Fever. Report by the Infectious Diseases Sub-Committee of the Scientific Advisory Committee, on a Comparison of Penicillin and Sulphonamide Treatment of Meningococcal Meningitis in Young Children

Department of Health for Scotland. Edinburgh, His Majesty's Stationery Office, 1947. 13 pages. 24 x 15 cm. 4d. [£0.0167]

The Scientific Advisory Committee of the Department of Health for Scotland has now produced a second report on the treatment of meningococcal meningitis, supplementary to that published in 1944. It compares the results of penicillin and sulphonamide treatments given alternately, as far as possible to children under 5 years of age. The treatment was carried out in five large hospitals for infectious diseases. The dosage schedule for sulphathiazole (or other active sulphonamide) was similar to that recommended in War Memorandum No. 10 of the Medical Research Council. The penicillin scheme of treatment consisted of 200,000 units systemically on the first day of treatment and 5,000 units intrathecally each day for four days for children under 1 year of age, and double these amounts for children of 1 to 5 years.

The number of cases treated was, unfortunately, too small for statistically significant results to be obtained. Nevertheless, the results exhibit a clear trend in favour of sulphonamide treatment. Although this result was converse to the expectation of the authors it was in line with the impression gained clinically as the trial progressed. The actual figures showed 11 unsuccessful results with penicillin out of 35 treatments, compared with 5 unsuccessful results with sulphonamides out of 31 treatments. When the age distribution of the two groups is taken into account, however, the superiority of sulphonamides is even more apparent, for less than half of the penicillin cases, and as many as two-thirds of the sulphonamide cases, were in the unfavourable age group under 1 year. An additional group of 15 cases, which all recovered, received treatment with both drugs, and although no conclusion can be drawn from this the Committee has embarked on a further investigation of the effects of the combined treatment. Certain minor findings of the report are that sex distribution may be neglected in any comparison of results, that the age-group under 1 year should be separated from that of 1 to 5 years, that the occurrence of complications was a most important factor in determining the outcome, and that the duration of illness before admission, that is, delay in starting hospital treatment, appeared to be a factor in worsening prognosis.

The complications which are enumerated appear to indicate that all the cases under treatment were the "ordinary form" of the disease. It is to be hoped that in future enquiries the Committee will be able to include fulminating septicaemia and other highly fatal forms of the disease, for it is in these that the combination of sulphonamides and penicillin is likely to be most successful.

H. S. B.

### The National Health Service Act, 1946. Being the Complete Text of The National Health Service Act, 1946, with an Introductory Explanation of the Act

J. A. Scott. London, Eyre & Spottiswoode Ltd., 1947. 103 pages. 24 x 15 cm. 5s. 6d. [£0.475]

In the heat generated by the controversy over the operation of the Act this book comes as a cooling

influence. The text itself is available elsewhere, so its value lies in the amplifications, which consist of an index and an introduction. The index, compiled by the Librarian of the Inner Temple, is an expert piece of work and will enable those desiring ready reference to particular points to secure it without wasted effort.

The contribution of Dr. Scott, Lecturer on Hygiene in St. George's Hospital Medical School, is an introduction which sets out in dispassionate terms the steps which brought the Act into being and analyzes its contents. He devotes several pages to the Draft Interim Report of the Medical Planning Commission of the British Medical Association and to the problem of the health centres. He draws attention to the importance of representation of "consumer" interests on administrative bodies, thus emphasizing that patients as well as doctors must have their say. The introduction is only the first word on a subject on which the last will not be written for a very long time, but it enables the reader to see in perspective the aspirations for a greatly improved and comprehensive health-service which have motivated the Act.

D. T. Richnell

### Survey and Field Treatment of Malaria in Mauritius

George Sippe & May Twining. Colony of Mauritius. London, Crown Agents for the Colonies, 1946. v + 76 pages; illustrations. 26 x 16 cm. £1 5s. [£1.25]

Mauritius is an island of 700 square miles<sup>1</sup> and has a population of 400,000, or nearly 600 per square mile. The survey, which was carried out in 1942-43 in response to war-time needs, covers the island in detail. The results show that malaria is hyperendemic in the lowland areas and that figures correspond very closely to those recorded by Ross & Fowler in 1903. Greatest incidence is found below 600 feet<sup>2</sup>; during the summer months; and in Creoles and Hindus, the poorest section of the population. In many villages the splenic index is 100%. The effect of chronic malaria on the splenic rate, parasite-rate, carrier-rate and death-rate is discussed. A clear picture of the relationship of the disease to poverty, malnutrition and macrocytic anaemia emerges. The elimination of mosquito breeding-places is not discussed. "Adequate control" was achieved by atabrin treatment, supplemented by improved nutrition, but whether this can be maintained in peace-time is an unanswered question. The conquest of malaria and the conquest of poverty are clearly shown to be interdependent. The survey is admirably produced, printed on one side of the page, with illuminating charts and photographs.

D. T. Richnell

<sup>1</sup>1 square mile = 2.59 square km.—ED.]

<sup>2</sup>1 foot = 30.5 cm.—ED.]

### Inter-Allied Conferences on War Medicine, 1942-1945: Convened by the Royal Society of Medicine

Edited by Henry Lecheby Tidy. London, Staples Press Ltd. 531 pages; illustrations. 22 x 14 cm. £2 10s. [£2.5]

From December 1942 to July 1945, 24 conferences on war medicine were convened by the Royal Society of Medicine at its headquarters in London. The objects of these conferences were "the interchange and communication of medical experiences in the Field and of the practical application of medicine to the needs of warfare, and for the exposition of the general principles of administration and organization of the medical services." These objects were achieved

by inviting speakers from the allied forces with the necessary technical knowledge and practical experience. For obvious reasons these meetings were secret, and this book now releases some of the valuable and interesting papers presented. The first meeting opened with an account of the abyssinian campaign, and the conferences followed the course of the war through Libya, Tunis, Sicily and Italy and then from D-day to the German concentration camps.

An interesting section is devoted to vivid descriptions by officers of personal experiences in special episodes. Among these are stories by one who volunteered to remain behind at Dunkirk to care for the wounded, by a medical officer parachuted into Yugoslavia, by another who was dropped into Arnhem, the story of the Arctic convoy, and a dramatic description by Professor Richet of 15 months spent in Buchenwald concentration camp. Special subjects, such as malaria, selection of officers and personnel, infective hepatitis and general problems of examination of wounded also received their fair share of discussion. The final meeting was devoted to a review of progress made in war medicine and surgery since 1939 and of the lessons which had been learned. These conferences were held under the presidency of Major-General Sir Henry Letheby Tidy, Consulting Physician to the British Army who, with Dr. J. M. Browne Kutschbach, is responsible for the editing of this volume.

D. F. A.

### Massage and Remedial Exercises in Medical and Surgical Conditions

Noël M. Tidy. Seventh edition. Bristol, John Wright & Sons Ltd., 1947. viii + 480 pages; 190 figures. 22 x 14 cm. £1 5s. [£1.25]

This is now established as a standard textbook for senior students and junior teachers of physical therapy. The material contained makes no claim to originality, and the treatments recommended are drawn from many sources, but the synthesis has proved its worth. The 6th edition was published in 1944; the author states that only slight alterations have now been made, but there is a new description of carbachol ionization treatment in Raynaud's disease.

D. T. Richnell

### An Introduction to Clinical Perimetry

H. M. Traquair. Fifth edition. London, Henry Kimpton, 1946. xv + 330 pages; 255 illustrations. 25 x 19 cm. £1 16s. [£1.8]

This new edition of a standard work is described as "revised and enlarged", but its length and format appear to be almost identical with those of the previous edition. However, it would be mere carping criticism to raise objection to an excellent production on the score of its not being longer. Suffice it that the high level is maintained.

The work has grown with the years from an essay originally written in 1920, and in this edition it has undergone further revision, including changes in the anatomical terminology to "bring it into line with modern usage." It is wholeheartedly to be recommended to ophthalmologists.

D. T. Richnell

### Cirugía

Rafael Urzua. Santiago de Chile, Editorial Tegualda, 1947. 691 pages; 100 illustrations. 23 x 15 cm.

This book is based on lectures delivered by the author to his students in the University of Chile.

It is intended for students and young surgeons, especially men who are starting a career in surgery in remote districts where they cannot obtain advice from more experienced colleagues in emergencies, or consult works in specialist libraries. The author points out, however, that the art of surgery cannot be learnt from books, but only supplemented by them.

Professor Uruza, in his section of general observations, offers much useful advice about the surgeon's attitude to his patients, the physical and mental qualities which he should possess or endeavour to cultivate, and pre-operational preparation. The book is simply written and the various operations are clearly described and illustrated. An appendix gives an alphabetical list of words used in surgical terminology, together with an explanation of their meaning in non-technical language.

V. E. C. M.

### Modern Treatment Year Book 1947 : A Year Book of Diagnosis and Treatment for the General Practitioner

Edited by Cecil Wakeley. London, The Medical Press, 1947. viii + 354 pages; 38 figures. 22 x 14 cm. 15s. [£0.75]

This yearbook, now in its 12th year, has firmly established itself on the bookshelf of the general practitioner as a readable and practical textbook of modern diagnosis and treatment. Under the editorship of Sir Cecil Wakeley, 47 specialists have contributed chapters on a wide range of subjects, including influenza, prematurity, pneumonia, various ophthalmic disorders, hysteria and skin diseases. There is an adequate index.

D. F. A.

### Practical Biology for Medical and Intermediate Students

C. J. Wallis. Second edition. London, William Heinemann Medical Books Ltd., 1947. ix + 396 pages; 211 figures. 22 x 14 cm. £1 1s. [£1.05]

The 1st edition of this book appeared in 1935 and the 2nd has been revised and reset. It covers the syllabi in biology for the First Examinations for Medical Degrees and those of similar content and is intended as a laboratory manual. It is divided into four sections: Microscopical Technique, Elementary Biochemistry, Plant Biology, and Animal Biology, with appendices dealing with the preparation of reagents, biological methods, etc. There is also a list of firms supplying biological apparatus and material.

L. J.

### Practical Pharmacognosy

T. E. Wallis. Fifth edition. London, J. & A. Churchill Ltd., 1948. ix + 230 pages; 73 figures. 22 x 14 cm. 15s. [£0.75]

This work, now in its 5th edition, is supplementary to the author's *Textbook of pharmacognosy* (Churchill, 1946). It describes the practical investigation into the origins and characteristics of crude drugs as well as the means of identification and establishment of criteria of purity.

The first part of the book deals with the practical study of drugs in common usage and consists of a number of schedules of instructions detailing the observations of greatest importance. Short notes with illustrative sketches are included as well as a certain amount of microscopic work, more particularly of those drugs such as starches, hairs, fibres and broken leaves whose characteristics can be studied

only by this means. Guidance in the description of drugs is given, skeleton-reports for the description of plant-members, etc., being included.

The latter and more-advanced half of the book deals with histological and microscopical work. The section on quantitative analysis has been extended by exercises on *nux vomica*, cinnamon and lycopodium. The use of ultra-violet light is given under the schedule for *rubarb* on page 83. The characters of pollen grains as aids to the identification of drugs have been conveniently summarized in a Table and several figures. The histological schedules now include information on the double staining and mounting of botanical sections.

Dr. Wallis is to be congratulated upon this new edition of his manual of practical pharmacognosy. Clearly written, accurately and critically illustrated, it is the standard guide to students reading for qualifications or degrees in pharmacy.

A. Lochter

### A Handbook on Diseases of Children: including Dietetics & the Common Fevers

Bruce Williamson. Fifth edition. Edinburgh, E. & S. Livingstone Ltd., 1947. xii + 408 pages; 87 illustrations. 19 x 12 cm. 15s. [£0.75]

The present edition is well produced like its predecessors; the illustrations are an outstanding feature of the book, which is printed on glossy paper of excellent quality. The book is eminently readable, and is constantly enlivened by reference to the author's own experience. Many readers overseas will find the dosages translated in terms of the metric system one of the most useful features of the work. As stated in the preface, the volume "has been thoroughly revised and incorporates treatment by penicillin and other newer compounds." Thus benadryl is mentioned in connexion with angoneurotic and urticarial conditions.

Rare conditions are mentioned if the author considers them to be important, e.g. chronic constrictive pericarditis, on pages 75-76. The formulae which concludes the book is a most useful feature, though on page 380 only the oral route for the sulphonamides is suggested, and the author does not mention alternative routes if the patient vomits or is unable to swallow. It is true that the intravenous route is indicated in the table on page 381 which is compiled from the Medical Research Council's War Memorandum No. 10 (1943). In the discussion of warts (page 215), no mention is made of plantar warts. But in a work covering such a wide field many readers are bound to regret some omissions, so that such criticisms do not detract from the usefulness of a splendid little book.

F. T.

### Biologists in Search of Material: an Interim Report on the Work of the Pioneer Health Centre, Peckham

Edited by G. Scott Williamson & I. H. Pearce. Second edition. London, Faber and Faber Ltd., 1947. 107 pages; 5 illustrations. 21 x 14 cm. 5s. [£0.25]

This edition has little new to add to that of 1935 for the very good reason that the war greatly interrupted the work of the Centre, but the present day, with its increasing interest in the problem of national health, is an appropriate time for the appearance of a 2nd edition.

The Peckham Centre is not planned solely for regular medical overhaul and general health guidance. It is not an end in itself but a means to an end—the provision of material for a comparative study of the physical processes of health and wellbeing. That it

does not follow the usually accepted pattern of a health- or community-centre is no valid criticism. In spite of considerable pre-war interest, there remained in many minds much vagueness or misconception about the main object of the Peckham Centre. It is good that this object and the methods proposed for its attainment should be set out again for the sake of the stimulus and suggestions of methods which others may find in a study of the Peckham experiment.

P. W.

### Health Services in England

R. C. Wofinden. Bristol, John Wright & Sons Ltd., 1947. x + 191 pages. 19 x 13 cm. 10s. [£0.5]

Awarded the Joseph Rogers prize in 1946 for "the best or only good essay on the treatment of the sick poor of this country and the preservation of the health of the poor", this lucid little book summarizes measures taken in Great Britain to provide for the treatment of the sick and to preserve the health of all social classes. It reviews the achievements of the health services and concludes with a postscript on the National Health Service Act, 1946, placed on the statute book after the completion of the essay.

H. C.

### A Text-Book of Gynaecology: for Students and Practitioners

James Young. Seventh edition. London, Adam & Charles Black, 1947. xi + 471 pages; 277 illustrations. 22 x 14 cm. £1 10s. [£1.5]

New editions of this textbook for students and practitioners by the London University Professor of Obstetrics and Gynaecology have been appearing regularly since 1921. The 7th contains many additions and revisions, particularly in that ever-developing sphere, sex endocrinology. The section on ovarian tumours has also been expanded. For all its length the book is conveniently compact, being printed on thin paper, on which the illustrations none the less show up well.

D. T. Richnell

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## Books Received

October 1947—February 1948

Reviews of many of these books appear in this number of the Bulletin or will appear in future numbers

Abbott Laboratories International Co. *Revision de los conocimientos actuales sobre la penicilina*. 1946. Abbott Laboratories International Co. (Chicago)

Adams, H. S. *Milk and food sanitation practice*. 1947. The Commonwealth Fund (New York); Geoffrey Cumberlege, Oxford University Press (London), 18s. [£0.9]

Alexander, H. L. *Synopsis of allergy*. 2nd ed. 1947. Kimpton (London), £1

Allison, D. R. & Gordon, R. G. *Psychotherapy: its uses and limitations*. 1948. Geoffrey Cumberlege, Oxford University Press (London), 8s. 6d. [£0.425]

Angove, H. S. *Remedial exercises for certain diseases of the heart and lungs*. 2nd ed. 1948. Faber & Faber (London), 10s. 6d. [£0.525]

Arias Vallejo, E. *Disfunciones motoras del estómago*. 1947. Graficas Valera (Madrid)

Bacharach, A. L. *Science and nutrition*. 3rd ed. 1947. Watts (London), 6s. [£0.3]

Bamford, F. *Poisons: their isolation and identification*. 2nd ed., revised by C. P. Stewart. 1947. Churchill (London), £1 1s. [£1.05]

Barber, H. *The occasion fleeting*. 1947. Lewis (London), 15s. [£0.75]

Bartley, S. H. *Vision: a study of its basis*. 1941. D. Van Nostrand Co. (New York), £1 1s. [£1.05]

Beaumont, G. E. *Medicine: essentials for practitioners and students*. 5th ed. 1948. Churchill (London), £1 10s. [£1.5]

Beaumont, G. E. & Palmer, K. N. V. *Practical points in penicillin treatment*. 2nd ed. 1947. Churchill (London), 1s. 6d. [£0.075]

Board of Control. *Lunacy and mental deficiency. The thirty-third annual report of the Board of Control for the year 1946. Part I*. 1947. His Majesty's Stationery Office (London), 9d. [£0.0375]

Boyd, W. *A text-book of pathology: an introduction to medicine*. 5th ed. 1947. Kimpton (London), £2 8s. [£2.4]

Breen, G. E. *Essentials of fevers*. 2nd ed. 1948. Livingstone (Edinburgh), 15s. [£0.75]

British Commonwealth Scientific Conference, 1946. *Specialist conference on culture collections of micro-organisms*. London, August, 1947. *Report of proceedings*. 1947. His Majesty's Stationery Office (London), 6d. [£0.025]

British Journal of Radiology. *Supplement No. 1. Report of London Conference held May 13-14, 1946 on certain aspects of the action of radiation on living cells*. 1947. British Institute of Radiology (London), 15s. 6d. [£0.775]

Brompton Hospital. *Brompton Hospital Report. A collection of papers recently published from the Hospital. Volume XV, 1946*. 1947. Research Department of Brompton Hospital (London), 10s. [£0.5]

Brown, J. A. C. *The distressed mind*. (The Thinker's Library, No. 115.) 1946. Watts (London), 2s. 6d. [£0.125]

Burn, J. H. *The background of therapeutics*. 1948. Geoffrey Cumberlege, Oxford University Press (London), £1 2s. 6d. [£1.125]

Carling, E. R. & Ross, J. P., editors. *British surgical practice. Vol. 1. [Abdominal Emergencies to Autonomic Nervous System]*. 1947. Butterworth (London), £3

Carling, E. R. & Ross, J. P., editors. *British surgical practice. Vol. 2. [Bockache to Bursae]*. 1948. Butterworth (London), £3

Casanovas, J. *Traumatología ocular de urgencia*. (Colección Española de Monografías Médicas, Vol. 67-68.) 1947. Ediciones B.Y.P. (Barcelona)

Chamberlain, E. N. *Symptoms and signs in clinical medicine: an introduction to medical diagnosis*. 4th ed. 1947. Wright (Bristol), £1 10s. [£1.5]

*Chemist and Druggist diary and year book*, 1948. 1947. Chemist & Druggist (London)

Clark, W. E. Le G. *Anatomical pattern as the essential basis of sensory discrimination*. 1947. Blackwell (London), 1s. [£0.05]

Copeman, W. S. C. *The treatment of rheumatism in general practice*. 4th ed. 1946. Arnold (London), 12s. 6d. [£0.625]

Congreso Interamericano de Cirugía. *Tercer Congreso—Tomo I, II, III, Montevideo, 1-6 Octubre de 1946*. 1947. Talleres Gráficas de A. Monteverde (Montevideo)

Coward, K. H. *The biological standardization of the vitamins*. 2nd ed. 1947. Baillière (London), 16s. [£0.8]

Crew, F. A. E. *Genetics in relation to clinical medicine*. 1947. Oliver & Boyd (London), 10s. [£0.5]

Daley, R. & Miller, H. G., editors. *Progress in clinical medicine*. By various authors. 1948. Churchill (London), £1 1s. [£1.05]

Darling, H. C. R. *Elementary hygiene for nurses. A handbook for nurses and others*. 9th ed. 1947. Churchill (London), 7s. 6d. [£0.375]

De Swiet, J. *Essentials for final examinations in medicine*. 3rd ed. 1947. Churchill (London), 9s. [£0.45]

Dicks, H. V. *Clinical studies in psychopathology. A contribution to the aetiology of neurotic illness*. 2nd ed. 1947. Arnold (London), 15s. [£0.75]

Doggart, J. H. *Children's eye nursing*. 1948. Kimpton (London), 8s. 6d. [£0.425]

Doolin, W. *Wayfarers in medicine*. 1947. Heinemann (London), £1 1s. [£1.05]

Drinker, C. K. et al. *Psychiatric research*. (Harvard University Monograph in Medicine and Public Health: 9.) 1947. Harvard University Press (Cambridge, Mass.); Geoffrey Cumberlege, Oxford University Press (London), 11s. 6d. [£0.575]

Duran-Reynals, M. L. *The fever bark tree. The poscaut of quinine*. 1947. Allen (London), 8s. 6d. [£0.425]

Elderton, W. & Fippard, R. C. *The construction of mortality and sickness tables. A primer*. 4th ed. 1947. Black (London), 6s. [£0.3]

Engel, S. *The child's lung: developmental anatomy, physiology and pathology*. 1947. Arnold (London), £2

Engle, E. T. *Proceedings: Conference on diagnosis in sterility. Sponsored by the National Committee on Maternal Health*. 1947. Blackwell (Oxford), £1 5s. [£1.25]

Escudero, P. *El presente y el futuro del problema alimentario de Bolivia. Informe técnico elevado al poder ejecutivo de Bolivia*. (Publicaciones del Instituto Nacional de la Nutrición, Cnp 30.) 1947. Instituto Nacional de la Nutrición (Buenos Aires)

English, C. *Diseases of the breast*. 1948. Churchill (London), 8s. 6d. [£0.425]

Esnaurrizar, M. L. *Dolores mortales agudos esplénicos*. 1947. E. C. L. A. L. (Mexico, D.F.)

Ewen, J. H. *Mental health. A practical guide to disorders of the mind. With a chapter on special treatments and their practical technique*, by C. Friedman. 1947. Arnold (London), 12s. 6d. [£0.625]

Fitzwilliams, D. C. L. *Cancer of the breast*. 1947. Heinemann (London), £1 5s. [£1.25]

Flogel, J. C. *Population, psychology, and peace*. (The Thinker's Library, No. 117.) 1947. Watts (London), 2s. 6d. [£0.125]

Ford, R. *Chronic ill-health relieved by drainage of the paranasal sinuses*. 1948. Kimpton (London), 6s. [£0.3]

Francis, J. *Bovine tuberculosis: including a contrast with human tuberculosis*. 1947. Staples Press (London), £1 5s. [£1.25]

Freud, A. et al., editors. *The psychoanalytic study of the child. Volume 2, 1946*. 1947. Imago (London), £1 10s. [£1.5]

Gardiner, [F.] *Gardiner's handbook of skin diseases*. 5th ed., revised by John Kinnear. 1948. Livingstone (Edinburgh), 15s. [£0.75]

Gesell, A. & Amatruda, C. S. *Developmental diagnosis: normal and abnormal child development. Clinical methods and pediatric applications*. 2nd ed. 1947. Hamish Hamilton (London), £1 12s. 6d. [£1.625]

Gilmour, J. R. *The parathyroid glands and skeleton in renal disease*. 1947. Geoffrey Cumberlege, Oxford University Press (London), 18s. [£0.9]

Glover, E. *Basic mental concepts, their clinical and theoretical value*. 1947. Imago (London), 3s. 6d. [£0.175]

Glover, E. *The social and legal aspects of sexual abnormality*. 1947. Institute for the Scientific Treatment of Delinquency (London), 1s. [£0.05]

Graves, C. *The story of St. Thomas's, 1106-1947*. 1947. Faber & Faber for St. Thomas's Hospital (London), 8s. 6d. [£0.425]

Hadfield, H. & Garrod, L. P. *Recent advances in pathology*. 5th ed. 1947. Churchill (London), £1 1s. [£1.05]

Hall, L. S. *Diseases of the nose, throat and ear. A handbook for students and practitioners*. 4th ed. 1948. Livingstone (Edinburgh), 15s. [£0.75]

Hamilton, G. *Psychotherapy in child guidance*. 1947. Columbia University Press (New York); Geoffrey Cumberlege, Oxford University Press (London), £1 2s. [£1.1]



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- Harris, D. T. *Experimental physiology for medical students*. 4th ed. 1947. Churchill (London), 18s. [£0.9]
- Harris, D. T. *Practical histology for medical students*. 4th ed. 1947. Lewis (London), 12s. 6d. [£0.625]
- Hegglin, R. *Die Klinik der energetisch-dynamische Herzinsuffizienz*. 1947. S. Karger (Basel), sw. fr. 19
- Hewer, E. E. *Textbook of histology for medical students*. 4th ed. 1947. Heinemann (London), £1 1s. [£1.05]
- Hill, A. B. *Principles of medical statistics*. 4th ed. 1948. *Lancet* (London), 10s. 6d. [£0.525]
- Himsworth, H. P. *Lectures on the liver and its diseases: comprising the Lowell Lectures delivered at Boston, Massachusetts, in March 1947*. 1947. Blackwell (Oxford), 18s. 6d. [£0.925]
- Hollingsworth, L. S. *The psychology of the adolescent*. 1947. Staples Press (London), 10s. 6d. [£0.525]
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- Hollingsworth, C. F. W. *A short textbook of surgery*. 4th ed. 1947. Churchill (London), £1 10s. [£1.5]
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- Jamaica, British West Indies. *Report of the Medical Department for the year ending December 31, 1946*. 1947. Medical Department (Jamaica)
- Jamieson, E. B. *Illustrations of regional anatomy*. Sections I-VII. 7th ed. 1947. Livingstone (Edinburgh), £3 15s. [£3.75]
- Jersild, A. T. *Child psychology*. 3rd ed. 1947. Staples Press (London), £1 10s. [£1.5]
- Johnstone, R. W. *The midwife's text-book of the principles and practice of midwifery*. 3rd ed. 1947. Black (London), 18s. [£0.9]
- Jonckheere, F. *Le papyrus médical* (Bruxelles) (La Médecine Égyptienne No. 2.) 1947. Fondation Égyptologique Reine Elisabeth (Bruxelles)
- Kessler, H. H. *Rehabilitation of the physically handicapped*. 1947. Columbia University Press (New York); Geoffrey Cumberlege, Oxford University Press (London), £1
- Khoo, F. Y. *Bone dystrophies. A systematic review and correlation*. 1945. Canadian Mission Press (Chengtu)
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- McIntyre, A. R. *Curare: its history, nature, and clinical use*. 1947. University of Chicago Press (Chicago); Cambridge University Press (London), £1 7s. 6d. [£1.375]
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## Films

*The four films reviewed in this section have been completed by Imperial Chemical Industries Ltd. and are designed as visual aids to medical instruction. They were shown at the XVII International Physiological Congress in Oxford in July 1947, and are important in that they mark the return to the front rank, after a lapse of some years, of films dealing with physiology and physiological techniques*

1285

### Perfusion of the Living Animal [Dog]

made at Department of Physiology, Edinburgh University; owned by Imperial Chemical Industries Ltd.; technical adviser, Professor I. de Burgh Daly; directed by Cyril Jenkins; unit, Film Producers' Guild; available in 16 mm. sound, 1,600 feet [488 m.]; kodachrome; 34 minutes

For a number of years Professor I. de Burgh Daly and his colleagues in the Department of Physiology at the University of Edinburgh have been engaged in the study of pulmonary vasomotor and bronchomotor activity. The perfusion apparatus which they designed for the unequivocal proof of pulmonary vasomotor activity is demonstrated in this film. It is substantially the same as that described by Daly *et al.* in 1942 (*Quart. J. exp. Physiol.* 31, 227), but with some added refinements; the need for such an elaborate apparatus is well explained in this paper.

In order to ensure that recorded changes in pulmonary arterial pressure were due solely to pulmonary vasomotor nerve stimulation, certain desiderata were also postulated in the same paper. These included a constant systemic arterial pressure; constant inflow of blood to the lungs; constant pressure in both auricles; negative pressure ventilation of the lungs; maintenance of the functional integrity of the pulmonary nerves; separation of bronchomotor from vasomotor effects on pulmonary pressure. It was also desirable that the animal should remain alive during the experiment; that it should not suffer from anoxia at any stage;

that the state of the blood should approach normal; and lastly that the depth of anaesthesia should be under exact control all the time.

The film starts with a general view of the whole apparatus and is followed by one of a model which is rotated so that the essential parts can be seen from all sides. Next follows a diagram of the perfusion circuit which is in two parts, systemic and pulmonary.

Heparinized and filtered blood from several donor dogs flows from the first reservoir to the "systemic" Dale-Schuster pump which replaces the left ventricle. From this pump the blood goes to cannulae in the femoral arteries, thence via the systemic circulation of the whole animal to reach the right auricle. From the right auricular appendix a cannula and tube lead the blood to a second reservoir. The pulmonary circulation is from this reservoir to a second Dale-Schuster pump which passes it by means of a specially shaped cannula through the right ventricle into the pulmonary artery and thus to the lungs. The blood returning to the left auricle is led by a cannula and tube back to the first reservoir, thus completing the circuit. The auricles continue to beat throughout the experiment as their blood supply is intact. In addition to the perfusion circuit already described there is a Hooker-Drinker oxygenator shunted across the reservoirs. In this shunt the blood is exposed to a gas mixture of 95% O<sub>2</sub> and 5% CO<sub>2</sub> which keeps it oxygenated and maintains the pH at 7.2. With this system the respiratory centre may remain active for about eight hours.

The operating table is electrically heated and the reservoirs and Dale-Schuster pumps are immersed in a thermostatically controlled water-bath. For the preliminary stages positive pressure ventilation of the lungs is needed and is supplied by a Starling "Ideal" pump. Later, when negative pressure ventilation, which more nearly approaches normal respiration, is required, a metal chamber is slid over the operating table and fixed in an airtight manner. The chamber is connected to a vacuum pump providing continuous suction. Respiration is controlled by the admission of air to the chamber by a mechanically operated valve.

The tracheal cannula is connected to a closed respiration circuit which includes a soda-lime absorber for CO<sub>2</sub>, a respirometer giving a kymograph record, and provision for the admission of oxygen and for cyclopropane. This anaesthetic is used during the experimental, as opposed to the preliminary operative, period.

The film then shows the various stages of the operation in considerable detail and with great clearness. The dog is anaesthetized, usually with chloralose, and its trachea is exposed, cannulated, and connected to the respiration pump. Great care is taken to secure haemostasis, use being made of diathermic

electrocoagulation for the purpose. The cervical vagosympathetic nerves are exposed and picked up on loose ligatures for stimulation at a later stage.

The heart is exposed and ample time allowed for the firm clotting of any small oozing vessels. This is important, as heparin is given later. The phrenic nerves are crushed to prevent diaphragmatic movements from interfering with tracing recording respiration. The pericardium is opened and the heart supported in a special cradle.

The blood from the donor dogs is equilibrated with the gas mixture; the reservoirs are filled and the pumps started, their outflow cannulae temporarily discharging back into the reservoirs. The femoral arteries are exposed and heparin is given intravenously. A manometer-recording on the kymograph is then connected to a cannula in the left common carotid artery so as to obtain a record of the systemic blood pressure. The femoral artery cannulae are then inserted, though their attached tubes are temporarily clamped and the "systemic" pump turned off.

Special cannulae are inserted into the right and left auricular appendices, connected, as already described, to the reservoirs. The systemic side of the perfusion is now begun by opening the clamps on the tubes leading to the femoral cannulae and starting the systemic pump.

The final stage of the operation is the insertion of a long curved cannula into the pulmonary artery, which is done by making an incision in the tip of the right ventricle and passing the cannula through the heart. It is held in place by strong tapes tied firmly round the whole heart and embracing both ventricles. The pulmonary pump is started and adjusted to give a pressure of 25 mm. Hg which is also recorded on the kymograph.

The operation is now complete and some experiments can be done while the lungs are still working with positive pressure respiration. For example, the addition of 5  $\mu$ g. of adrenalin to the right auricular reservoir causes a temporary rise in blood pressure. The increase in frequency of the auricular beats is beautifully demonstrated in the film by a close-up view of them. Increasing the output of the systemic pump leads to a rise in systemic blood-pressure as shown on the kymograph record. Conversely, stopping this pump causes the pressure to fall and there is a period of apnoea which results as well. The effect of square-wave stimulation of the thoracic nerves is also shown in the film.

The sliding metal chamber is then put in place and the effects of negative pressure ventilation are demonstrated. Observation of the animal is still possible through a glass lid.

The pressure in the pulmonary artery falls owing to a diminution in the resistance of the pulmonary vascular bed. Vagal stimulation, after eserine, leads to bronchoconstriction and a fall in blood pressure due to stimulation of vasodilator fibres. Adrenalin, 5  $\mu$ g., injected into the tube leading to the pulmonary artery, causes a rise in pressure in that vessel. Adrenalin after ergotoxin leads to pulmonary vasodilation as shown by a fall in pulmonary arterial pressure; there is later a fall in the systemic blood pressure.

From this summary it can be seen that the experiments demonstrated are particularly well suited to reveal the presence of the pulmonary vasomotor fibres. The technique will, however, undoubtedly be of considerable value in the elucidation of other problems in the physiology of the cardiovascular and respiratory systems.

The film is beautifully produced and the spoken commentary is a model of lucid expression. It should serve as an example of all that a film, designed to demonstrate both an operative technique and physiological phenomena, should be.

A. G. Sanders

1286 (with 1287)

## The Humoral Transmission of Sympathetic Impulses

made at Department of Pharmacology, Oxford University, 1947; owned by Imperial Chemical Industries Ltd.; technical adviser, Professor J. H. Burn; directed by Cyril Jenkins; unit, Film Producers' Guild; distributed by Imperial Chemical Industries Ltd.; available only in 16 mm. sound, 700 feet [213 m.]; kodachrome; 14 minutes

1287

## The Properties of Acetylcholine

made at Department of Pharmacology, Oxford University, 1947; owned by Imperial Chemical Industries Ltd.; technical adviser, Professor J. H. Burn; directed by Cyril Jenkins; unit, Film Producers' Guild; distributed by Imperial Chemical Industries Ltd.; available only in 16 mm. sound, 700 feet [213 m.]; kodachrome; 22 minutes

The first of these films records an experiment designed to show that the contraction of smooth muscle induced by stimulation of its nerve-supply is effected not by an electrical phenomenon, but by the local release of a chemical substance at the nerve-endings. The experiment is designed to prove is first that the nerve-supply to a smooth muscle is stimulated; if then a chemical substance is released it should be detectable by the contraction produced in a distant smooth muscle whose nerve-supply has been interrupted.

The superior cervical ganglion in a cat is removed on one side, and an injection of adrenalin given. The response of the nictitating membranes, to which lever-and-pulley recorders have been attached, is seen on the kymograph: the operated side shows a greater response, thus exhibiting an increased sensitivity over the normal. Next the splanchnic nerves are divided and stimulated: this produces a negligible response on the normal side, but a marked response on the operated side greater even than that produced by the dose of adrenalin. Now the suprarenals are isolated and removed; when the splanchnics are again stimulated the affected side contracts significantly, while at the same time the blood-pressure tracing rises; the normal side shows no response. So it is shown that stimulation of the splanchnic nerve must have released from the gut some such substance as is produced by the adrenal glands.

The pictorial quality and the smooth exposition of this film combine to present clearly and memorably the argument intended. It is, by its subject-content, a specialized film of use only for physiology students, but here it should find routine use in the standard curricula, for it is short enough to be fitted into the normal lecture—indeed, it presents the subject more forcefully and in a shorter time than has been possible hitherto.

The second film—on the properties of acetylcholine—starts with a portrait of Sir Henry Dale, then presents the chemical structure of acetylcholine and next discusses the one-time mystery—why administration of this drug in small doses produces a fall in blood-pressure, but in large doses a rise. Sir Henry Dale's classical investigations are then repeated. In a cat-preparation a small quantity of the drug injected produces a fall in blood-pressure; by repeating the experiment on an isolated limb it can be seen that this fall must be due to arteriolar dilation. A larger dose of the drug produces a sharper fall in blood-pressure, due to superadded inhibition of the heart; this effect soon passes off, but the blood-pressure remains depressed to some extent, due to continuing arteriolar dilation. A similar effect on the heart can be produced by stimulation of the vagus, while the effect of acetylcholine on the isolated heart mimics vagal stimulations in the intact preparation. Atropine is an antagonist to acetylcholine. The raising of blood-pressure by high doses of acetylcholine is explained by its stimulant action on the suprarenals. Electrical stimulation of the superior cervical ganglion produces responses in the eye which are exactly repeated when the ganglion is painted with acetylcholine.

Here then we have a number of classical experiments collected in some semblance of order, and clearly presented for students to see. Perhaps there are rather too many items for the film to be used in one continuous length as made here; the lecturer may prefer to use it part by part, or else to discuss the whole subject-content fully before putting on the film as a conclusive summary.

It is interesting to note that these two films, together with the highly specialized "Perfusion of the Living Animal," represent the first physiology films to have been made for a number of years. Physiologists were for many years in the vanguard of film teaching, but during the last decade they have shown a tendency to cede this position to others. These three films put them once more to the fore; they are clear, and free of trimmings, admirably

conceived and executed, and commendably succinct. Not too fast for the audience they are designed for, they resist the temptation to consider side-issues or to loiter over non-essentials. The colour quality is excellent, the commentary (in English) clear, and the kinematic direction scientific and polished. Full use is made of close-up; and kymograph tracings, so often the stumbling-block to smooth pedagogy in these physiological films, are presented clearly and interestingly and are supplemented to the full by the commentary.

1288

## The Physiology of the Kidney

made at University College, London; owned by Imperial Chemical Industries Ltd.; technical advisers, Professor F. R. Winton & Dr. J. Richardson; directed by Cyril Jenkins; unit, Film Producers' Guild; available in 16 mm. sound, 2,000 feet [608 m.]; kodachrome; 45 minutes

This film demonstrates the relationship between renal function and the state of the circulation. It is suitable for medical students, and for revision purposes.

The film begins by showing the gross anatomy of the organ. A model shows the interrelation of the renal blood-vessels and the nephrons at a series of different magnifications. That the formation of urine from the blood takes place in the glomeruli by a process of ultra-filtration is illustrated by several experiments. The preparation used throughout the film is that of a dog anaesthetized with pentobarbitone (nembutal). In the first experiment an intravenous injection of half-strength egg albumin is given. Egg albumin has a molecular weight of 34,000, which is about half that of the plasma albumin. Urine samples are collected before and after the injection and tested for protein. The thick, white precipitate that is formed in the specimens collected after the albumin has been administered proves that this substance is freely excreted by the kidney. The animal next receives an injection of Evans blue, a dye of very high molecular weight, which does not colour the urine, whereas, when phenol red is given, the urine rapidly becomes pink, owing to the excretion of the dye. Phenol red, of course, has a very much smaller molecule than Evans blue. These *in vivo* experiments are followed by one in which the two dyes are put into cellophan tubes and immersed in water. Phenol red diffuses through the cellophan, whereas the Evans blue does not. Collectively, these experiments indicate that the urine issuing from the glomerulus is an ultra-filtrate of the plasma.

The preparation of the animal and the kymograph records are then explained in greater detail. Arterial pressure is recorded by a cannula in the femoral artery, venous pressure by one in the external jugular vein; the urine outflow of the right kidney and the pressure in the left ureter are recorded also. The effects on the excretion of urine of variations in the circulation are next demonstrated. A rise in systemic blood pressure does not cause an increase in the flow of urine, because the renal vascular system compensates for the rise in pressure. The intravenous injection of adrenalin also causes a rise of blood pressure and a slowing of the heart beat. The renal arterioles, however, are also constricted so that the flow of urine stops instead of being increased. The absence of any direct control over the renal blood vessels by the vagus is shown.

Electrical stimulation of the vagus causes a fall in arterial blood pressure which in turn lowers the pressure in the glomerular capillaries and results in a decrease in the output of urine. Stronger stimuli of the vagus cause at first a rise of venous pressure as well as a drop in the arterial pressure and again the output of urine is diminished. After the period of stimulation there is one of over-compensation when these effects are reversed.

The effect of a sudden and severe haemorrhage is next shown. Very little change occurs until about 180 cm.<sup>3</sup> of blood have been withdrawn, corresponding to a loss of about 2 litres in a man. After this amount has been withdrawn, the compensatory mechanism fails and there is a fall of arterial pressure with a slight drop also in the venous pressure. The result on the kidney is a diminution in the flow of urine. Restoration of the blood volume by the intravenous infusion of 200 cm.<sup>3</sup> of physiological saline restores the arterial pressure and also the glomerular filtration pressure. The flow of urine returns to normal and even rises above normal because the dilution of the blood with saline

inhibits the re-absorption of water from the urine as it passes through the renal tubules. Normally in man this re-absorption is very considerable.

Diuretics act in two principal ways, either by an increase in the glomerular filtration rate or by causing a decrease in tubular re-absorption of water. The mode of action of caffeine and of two of the "osmotic" group of diuretics is demonstrated in detail.

The film finishes with a résumé of the effects shown, illustrated by the complete kymograph record.

A. G. Sanders

1289

## Catalogue of Medical Films

compiled by The Royal Society of Medicine and The Scientific Film Association. London, Aslib, 1948. vii + 125 pages. 19 x 15 cm. 7s. 6d. [£0.375] (6s. to members of Aslib and SFA)

Part I. Title list of 800 films viewed. (i) Alphabetical cross-reference; (ii) subject-group index; (iii) numerical cross-reference. Part II. Details of 200 films arranged in numerical order. Appendix: the Scientific Film Association; the Royal Society of Medicine; Aslib.

This is a well-planned and comprehensive catalogue which will be invaluable to the growing number of users of medical films. An increasing amount of interest is being shown in the possibilities of the film as an aid to medical education and the appearance of this catalogue is therefore most welcome. Its compilation was made possible as a result of collaboration between the Royal Society of Medicine and the Medical Committee of the Scientific Film Association, although, since 1946, the Scientific Film Association has continued the work alone.

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# Guide to the Journals

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PART ONE  
MENTAL HEALTH

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## Introduction

The range of the articles in this number of the *British Medical Bulletin* gives a good though not complete impression of the breadth of the field which is now covered by psychiatry. In the past decade, and even since the end of the war, there has been a phenomenal increase in the intensity and the extent of the work done by psychiatrists, and done by others along psychiatric lines. It looks as though psychiatry may cease to be a purely medical discipline, for its boundaries now considerably overstep the limits of what can legitimately be called *psychological medicine*. The expansiveness of this activity is in large part due to the inspiration provided by psychoanalysis. From the account which Dr. Rees gives of the Congress on Mental Health held in London in 1948, one may see how ideas, which were originally derived from the psychotherapy of the individual, have recently been applied to the psychology of groups, with implications for the management of human relations in their most general form and even of world affairs. Psychoanalysis is as much a philosophy as a branch of medicine; and its basic concepts have found their way, not only into non-medical scientific fields such as sociology and anthropology, but also into literature and art.

Even the critics of psychoanalysis will admit that a revolution in psychology was begun by the publication of Freud's early papers at the end of the last century. Before that time the normal psychology of the individual was almost unbelievably arid. It was above all Freud's discovery that the springs of human action lie deeply buried in functional levels of nervous activity of which the individual himself is unconscious, and the discovery of a method of penetrating to those levels, that have transformed both medical and lay views on the interpretation of human behaviour. Freud began his career as a neurologist, and his





of hereditary factors in the endogenous psychoses, in personality development, and even in the constitutional predisposition to neurosis.

Of all the biological sciences, it is probably psychology which has had the greatest recent impact. The extent of the field which psychology and psychological medicine hold in common may be seen in the number and variety of contributions from psychologists to this number. The influence of psychology is shown both in the formulation of concepts and in the provision of techniques of investigation. Statistics, which now play such an important part in psychiatric research, have been introduced to psychiatry from psychology. As Sir Cyril Burt says, its distinctive characteristic consists in "the scrupulous adoption of scientific techniques in place of the old-fashioned reliance on personal experience, traditional precepts, and unaided commonsense." Psychiatry has gone a long way by the use of these older methods; nor can they ever be entirely out-dated. Before one can plan an experiment, one must have some idea of the question it will be framed to answer; and the questions will generally be raised by personal experience and commonsense, though never finally answered by them. We must hope that one day the scientific approach will be universally applied in psychiatry, and when that day comes psychiatry will be able to claim the full stature of a science. Apart from these invaluable gifts of method, we owe to psychology large stretches of conquered territory. It is psychologists, more than medical men, who have clarified the subject of mental deficiency, and have shown how much can be attributed to normal

variation, and what a relatively small proportion is attributable to pathological agents. In this field the work of psychologists and geneticists has been complementary, and readily combined, as both groups necessarily applied mathematical methods. It seems likely that the contribution of psychology will be as important to the study of temperament as to that of intelligence. And wherever psychiatry impinges on the non-pathological a psychological training provides weapons which a purely medical one does not.

It must not be thought that within psychiatry all these various trends of development are combined in a spirit of absolute harmony. Different schools offer different, even mutually exclusive, interpretations of the same phenomena. Where two ideas are in contradiction, we cannot expect to preserve both, and one or other must fall. Often the contradiction will not be of a fundamental kind, and we must look forward to the time of finding the higher synthesis which will resolve apparent antitheses. Yet we may be sure that in our harvest there are the seeds of many weeds, which, however strong their growth, will have to be eliminated. By their fruits we shall know them. In the present time of stormy growth there has been little leisure for the exercise of much-needed destructive criticism. Speculation, of which there has perhaps been overmuch in psychiatry, has its place, but cannot live unless it is subjected to, and survives, rigorous testing. When the tests are made, though we may have to abandon many cherished ideas, we can be reasonably sure that the present epoch will be found to have established much solid achievement.

Eliot Slater

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## Notes on Contributors

SIR FREDERIC C. BARTLETT is Professor of Experimental Psychology and Director of the Psychological Laboratory in the University of Cambridge, and a Fellow of St. John's College, Cambridge. He is a member of the Medical Research Council, Chairman of the Industrial Health Research Board and a member also of the Personnel Research Committees of the fighting Services. His own work has been concerned principally with problems of perception and remembering, and later with the development of the experimental studies of human skill behaviour. Among his more recent publications are *Remembering: an experimental and social study* (1932), and *Political propaganda* (1941); he also edited, with others, *The study of society* (1939).

SIR CYRIL BURT is Professor of Psychology in the University of London. He was educated at Oxford and Würzburg, held appointments in the School of Physiology at Liverpool under Sherrington, and in the Psychological Laboratory at Cambridge under Myers. From 1914 to 1931 he was Psychologist to the London County Council (Education Department) and during the later part of this time he also held the Chair of Educational Psychology in the University of London. He is a Fellow of the British Psychological Society and has worked on research in child guidance, vocational guidance, mental testing, psychoneurosis, and delinquency. He is at present Head of the Psychological Laboratory, University College, London, and member of

the War Office Advisory Committee on Personnel Selection and Honorary Consulting Psychologist to the Civil Service. Sir Cyril Burt's main publications are: *Distribution of educational abilities* (1917), *Mental and scholastic tests* (1921), *The young delinquent* (1925), *The measurement of mental capacities* (1927), *The subnormal mind* (1935), *The backward child* (1937) and *The factors of the mind* (1940); in addition, he is editor of the *British Journal of Psychology (Statistics)*.

SIR NORWOOD EAST is an authority on criminology and forensic psychiatry. He was educated at King's College School and King's College, London, and at Guy's Hospital. He has been for many

years lecturer in Forensic Psychiatry at the Institute of Psychiatry, Maudsley Hospital, London, and is one of the medical men appointed from time to time by the Home Secretary to report on the mental state of a prisoner on whom the capital sentence has been passed. He was formerly one of H.M. Commissioners of Prisons and Director of Convict Prisons, an inspector under the Inebriates Act, and during the Second World War a consultant to the Royal Navy. He was also a member of Departmental Committees on Prison Dietary and on Persistent Offenders. He has been President of the Society for Addiction, President of the Medico-Legal Society and President of the Psychiatric Section of the Royal Society of Medicine. He was a Vice-President of the 23rd Congrès de Médecine Légale, Paris, 1946, and also a Vice President of the International Congress on Mental Health, 1948. His publications include *Forensic psychiatry* (1927), *The medical aspects of crime* (1936), *The psychological treatment of crime* (jointly) (1939), *The adolescent criminal* (jointly) (1942), *Society and the criminal* (1949), as well as numerous papers in the medical journals, on crime and insanity.

DR. H. J. EYSENCK is the Director of the Psychological Department at the Institute of Psychiatry, and Senior Psychologist to the Maudsley and Bethlem Royal Hospitals. He obtained his Ph.D. degree from the University of London, and is a Fellow of the British Psychological Society, of the American Psychological Association, and a Fellow and Member of the Council of the Eugenics Society. His work has been mainly concerned with the psychology of personality, both in its abnormal and normal aspects; he has published extensively, also, in the fields of aesthetic appreciation and social attitudes. His best known work, *Dimensions of personality* (1947), describes large-scale experimental studies on neurotic and normal subjects, carried out during the war. His present work is concerned mainly with an extension of these studies to psychotic adult subjects and to normal and maladjusted children.

DR. MICHAEL FORDHAM is an analytical psychologist, who has been Chairman of the Society of Analytical Psychology and is the Director of the Society's Clinic. He is one of the editors of a forthcoming collected edition of Professor C. G. Jung's works. He has made a special study of child psychology and its relation to Jung's discoveries. He maintains that the archetypes of the collective unconscious can be demonstrated in the psychology of children, and amongst his publications is a book entitled *The life of childhood* (1944) in which he sets down the evidence for his views. He is at present Assistant Director of the Child Guidance Unit of the West End Hospital for Nervous Diseases.

DR. EDWARD GLOVER was trained in psychoanalysis under the late Karl Abraham of Berlin. Settling in London in 1922, he played an active part in the development of the Institute of Psycho-Analysis and of its London Clinic, of which he was for many years Director. He also organized much of the research activity of the British Psycho-Analytical Society. For a time he was Secretary of the International Psycho-Analytical Association. He was also one of the founders of the Institute for the Study and Treatment of Delinquency. An authority of international repute on the theory and practice

of psychoanalysis, he has published many books and numerous research monographs on these subjects. His most outstanding research contributions include the "nuclear theory" of ego-development, and an investigation of the causes of war, *War, sadism and pacifism* (1947). He is also the author of *Investigation of the technique of psycho-analysis* (1940) and of a general handbook on the subject, *Psycho-analysis* (1949).

DR. DENIS HILL is physician in Psychological Medicine to King's College Hospital, London. He is also physician to the Department of Applied Electrophysiology at the Institute of Psychiatry, Maudsley Hospital, London, and assistant physician to the corresponding department at the National Hospital, Queen Square. For ten years he has made a study of the application of electroencephalography to the problems of psychiatry. His published work includes a chapter on the epilepsies in Sargent & Slater's *An introduction to physical methods of treatment in psychiatry* (1948); "Cerebral Dysrhythmia: its Significance in Aggressive Behaviour" (*Proc. R. Soc. Med.* 1944, 37, 317), and "Electroencephalographic Studies of Psychopathic Personalities" (*J. Neurol. Psychiat.* 1942, 5, 47). With Watterson, he suggested that many of the minor anomalies found in the electroencephalograms of neuropsychiatric patients are due to defective maturation in the central nervous system.

DR. EMANUEL MILLER is physician and lecturer in Psychopathology at the Maudsley Hospital and physician in Child Psychiatry at St. George's Hospital, London. He is also Co-Director of the Institute for the Scientific Treatment of Delinquency, a Fellow of the Royal Society of Medicine and of the British Psychological Society. He has been physician at the Tavistock Clinic and Senior Psychiatrist to the West End Hospital for Nervous Diseases, London, and in 1926 he established the first child guidance clinic in Great Britain. During the war he was a lieutenant-colonel in the RAMC, worked on the War Office Selection Board, and later did research work in the War Office Department for Neurological Research and Statistics. Amongst other works, he has written *Neurological psychotherapy* (1926); with other authors, *Neuroses in war* (1940); and has edited *Growing child and its problems* (1937).

MR. CYRIL F. PENTON is an authority on the law relating to mental health. He has had twelve years' service with the Board of Control (Lunacy and Mental Deficiency), and is its Legal Senior Commissioner. Mr. Penton was educated at Eton and at Trinity College, Cambridge, and in 1942 he was made an honorary member of the Royal Medico-Psychological Association.

DR. FELIX POST qualified from St. Bartholomew's Hospital in 1939 and after general hospital work received his psychiatric training at the Mill Hill Emergency Hospital and at the Royal Edinburgh Hospital for Mental and Nervous Disorders. Following service with the RAMC as psychiatric specialist, in 1947 he was appointed assistant physician to the Maudsley Hospital, London. He is a member of the Royal Medico-Psychological Association and of the Royal Institute of Philosophy. His published work includes studies on mental patients over the age of 60 (*J. ment. Sci.* 1944, 90, 554) and on psychiatric illness in coal miners (*J. ment. Sci.* 1946, 92, 574).

DR. J. R. REES is a psychiatrist whose main interests have lain in the problems of the psychoneuroses and in the sociological approaches to mental health. He was one of the original staff of the Tavistock Clinic and later became its Medical Director. During the recent war he served for six years as Consulting Psychiatrist to the Army. He is at the present time President of the World Federation for Mental Health. Dr. Rees is the author of several publications, including *The health of the mind* (1936) and *The shaping of psychiatry by war* (1945).

DR. DEREK RICHTER is Director of the Neuropsychiatric Research Centre at Whitchurch Hospital, Cardiff and lecturer in Neuropsychiatry in the Welsh National School of Medicine. He qualified originally as an organic chemist at Oxford and then worked for some years with Sir Frederick Gowland Hopkins at Cambridge. His earlier work was mainly in pure chemistry, but at Cambridge he worked on enzymes and on endocrine action. His research on adrenaline and acetylcholine led him to develop a special interest in the nervous system, which he studied with Professor Golla at the Maudsley Hospital, London. Later he completed his medical qualification at St. Bartholomew's Hospital and during the war he was attached to the Neurosis Unit at Mill Hill Emergency Hospital. His recent research has included investigations on anxiety, on ageing and on the biochemical changes in the brain in emotional states. His publications include "Recent Progress in Psychiatry" (*J. ment. Sci.* 1944, 90, 74) and "Biochemical Aspects of Anxiety" (*Proc. R. Soc. Med.* 1945, 38, 674).

DR. W. CLIFFORD M. SCOTT is Medical Director of the London Clinic of Psycho-Analysis and lecturer in dynamic psychology at the Institute of Psychiatry, University of London. As a pupil of Professor Adolf Meyer (Johns Hopkins) and the late Professor C. Macfie Campbell (Harvard) he came to England to train with the British group of psychoanalysts. He has been connected with the psychoanalytic treatment of manic-depressive and schizophrenic psychoses. Apart from the psychopathology of psychoses, his chief work has been in attempting to link the "body image" concept of neurology to psychoanalytic concepts and ego development. He is the author of a number of articles which have appeared in medical and psychological journals.

DR. P. E. VERNON is Psychological Research Adviser to the Defence Services and the Civil Service Commission. He was educated at Cambridge University and worked there, and at Yale and Harvard, from 1927 to 1933, chiefly on the psychological study of personality and temperament, and on the psychology of music. After some experience of child guidance and of the training of teachers, he became head of the psychology department in the University of Glasgow from 1939 to 1947. During four years of the war he worked in the Admiralty and War Office personnel selection departments on construction and validation of psychological tests, and on other psychological and statistical studies of the abilities of recruits, selection and training methods, etc. He is the author of *Measurement of abilities* (1947); *The assessment of psychological qualities by verbal methods* (1939); *Studies in expressive movement* (with G. W. Allport) (1933), *Personnel selection in the British Forces* (with J. B. Parry) (1949); and of some fifty psychological tests and articles.

## THE INTERNATIONAL CONGRESS ON MENTAL HEALTH

London, August 1948

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- 1 First post-war congress
- 2 Mental Hygiene Conference
- 3 Statement of the International Preparatory Commission
- 4 Other activities
- 5 Results of the Congress

It may seem somewhat strange that a report on the Congress on Mental Health should introduce a symposium of scientific contributions. But as this number of *British Medical Bulletin* was originally planned with reference to the Congress and with the intention of giving participating members a survey of mental health work in Britain, it is not inappropriate that some note about the activities and results of the Congress should be recorded here.

### 1. First Post-War Congress

In the first place, it is worth noting that this large gathering of some 2,200 people concerned with questions of mental health was the first large-scale meeting of the kind called since the recent war. Fifty per cent of those attending came from overseas, from 54 countries, so that between 11 and 21 August 1948 a great many new contacts were made between workers from the various countries, and a very large number of old contacts and interests were renewed. Most unfortunately it proved impossible to find accommodation for the Congress in Oxford or Cambridge, so that we had to work against the difficulties and distractions of a large meeting in the centre of London.

Almost immediately after the end of the war, we in Great Britain were asked by three separate sponsoring international groups to arrange their next conferences in this country. Those bodies, the International Committee for Mental Hygiene, the International Committee for Child Psychiatry and the International Federation for Medical Psychotherapy, were obviously concerned with an overlapping group of scientific workers, so that we decided to run the three conferences consecutively, combining them into one Congress. Thirty months of planning and preparation were in fact not too long.

Comparatively little need be said about the Conferences on Child Psychiatry and on Medical Psychotherapy. For the most part they were orthodox conferences and the themes selected for them—"Personality development with special reference to aggression" and "Guilt"—stimulated the production of a number of excellent papers, though as foreseen it was difficult to have effective discussion with such large meetings. The second and third volumes of the Proceedings<sup>1</sup> of the Congress, which have recently been published, will be found to give a very complete record of these two conferences.

### 2. Mental Hygiene Conference

From the ideological angle and as an experiment in international co-operation, the week of the Mental Hygiene Conference provided a good deal more interest. The Organising and Programme Committees had from the first been concerned to arrange a meeting which would be stimulating and which would have some special relevance to the times in which we live. It was determined that for once the conference should in large measure break away from familiar procedures and that we should try to tackle the rather timely subject of applying our various skills in the mental health field to "sick groups", to communities and to national tensions, rather than limiting ourselves to the day-to-day developments of psychiatric and mental health work.

The mental hygiene movement has always emphasized the necessity for team work and the recent war has firmly underlined the importance of interprofessional co-operation in the field of mental health. Psychiatrists may indeed have to play a central role in all prophylactic planning just as in treatment, but psychologists, sociologists, educators, anthropologists, clergy and political scientists all have their contribution to make as people who are concerned with the understanding and welfare of human beings. For the Conference on Mental Hygiene we therefore chose as a dominant theme, "Mental health and world citizenship", and we then attempted to prepare for the conference so that it might in fact be a co-operative group activity, rather than a number of people passively listening to papers however thoughtful or well prepared.

Preparatory Commissions or discussion groups, which for the most part were interprofessional, were started in many countries and worked hard on the various aspects of this wide theme which made a special appeal to them. The final decision as to the topics for the plenary sessions of the Conference was not made until it became clear what the principal interests of the whole participating group were likely to be. This ambitious plan was both a success and a failure. It may be said to have failed because in fact there was not sufficient time for many of the groups to learn to work together and then to produce studies and factual material that were new. Many of them worked for a year and no doubt would have been glad of two years before making their reports. The groups did something of importance, however, in that they brought together, in many academic centres and other places, workers in the different professional fields who had never even met each other, far less worked together or made any attempt

<sup>1</sup> [Proceedings of the International Congress on Mental Health, London, 1948  
4 vols., H. K. Lewis & Co. Ltd., London, 1949.—Ed.]

previously to weld their ideas for the attainment of a common objective. Having done this, a great number of these groups are continuing to work together and some at least will become significantly productive in the future. Perhaps there was some justice in the remark of one commentator who described this as "the first large scale 'combined operations' by social scientists on a world level for the benefit, perhaps the survival, of mankind as a whole."

It may be said, therefore, that the Congress on Mental Health began its scientific work at least a year or more before August 1948; by early June 1948 over 300 reports had been sent in from national interprofessional groups with a membership of approximately 5,000 in 27 different countries. All the main divisions of the Conference theme were covered—"World citizenship and good group relationships"; "The individual and society"; "Family problems and psychological disturbance"; "Mental health in industry and industrial relations"; and "Planning for mental health; organisation, training, propaganda." Many of the documents sent in were of great value and we hope that they will be made available in their original form. So far as the Conference was concerned, however, an effort was made to co-ordinate and integrate these various reports; editors in Holland, USA and Great Britain set to work and produced carefully summarized reports, in sections, for the use of those who were to make the main communications to the plenary sessions, and for the consideration of an International Preparatory Commission, which met before the Congress.

### 3. Statement of the International Preparatory Commission

This International Preparatory Commission was composed of some 25 people from 10 different countries, representing long experience in some 10 professional disciplines, who lived and worked together for a fortnight in the country outside London. As a result of their very strenuous work, they produced an agreed *Statement*<sup>2</sup> covering the whole subject. This was no light task. Multi-professional thinking on topics of this kind is not just a matter of compromise or a statement of different points of view; some attempt has to be made to integrate the different approaches and produce something which might be called a new concept.

The *Statement* is extremely interesting. It clearly could have been made far more definite and perhaps more readable had it been the work of one person, but it is a quite remarkable document when one considers its origin and that it carries the agreement of so many people who were experts in their own particular fields. This international group suffered from the fact that there were no representatives either of Eastern Europe or of the Far East present, despite our efforts. The group were fully conscious that allowance would have to be made for this fact, and the difficulty of producing a statement which could be made applicable to countries with quite different cultural aspects was realized. The *Statement* was printed just in time for the Mental Hygiene Conference and was distributed to every member. Sections of it were discussed at length by some 20 or more

international discussion groups formed of Congress members and in turn their comments were submitted to the Conference and have been printed in the bulletin of the Congress. When the *Statement* was submitted for general approval to the whole conference of 2,000 members at the last session, it was accepted with only one dissenting voice.

The *Statement* is interesting in its emphasis upon "the modifiability of human behaviour throughout life, especially during infancy, childhood, and adolescence, by human contacts. Examination of social institutions in many countries shows that these also can be modified." Later it says:

Men have long accepted the inevitability of recurring misfortunes in the shape of group conflict and war on the grounds that 'that is human nature'. This belief has even been used to maintain the existing state of affairs. When, however, social and psychiatric science had progressed sufficiently, the rigorous investigation of 'human nature' clearly revealed that these discouraging traditional views had no valid foundation . . .

Man and his society are closely interdependent. Social institutions such as family and school impose their imprint early in the personality development of their members, who in turn tend to perpetuate the traditional pattern to which they have been moulded. It is the men and women in whom these patterns of attitude and behaviour have been incorporated who present the immediate resistance to social, economic and political changes.

Thus prejudice, hostility, or excessive nationalism may become deeply imbedded in the developing personality without awareness on the part of the individual concerned, and often at great human cost.

Perhaps the most important contribution of the social sciences in their joint approach to the urgent problems facing mankind is the recognition of the plasticity of human behaviour and social institutions and of the resistance of each to change.

The final paragraph before the recommendations concludes:

There is no room here for any easy optimism. Men's hopes for world peace have been shattered so often in the past, that we would be doing a disservice to humanity if we did not fully recognize the difficulties which must still be overcome. Nor can we take it for granted that the insights gained by psychiatrists and social scientists will necessarily be employed in the interests of a world community. Just as the discoveries of the physicist can be used to construct or to destroy, so too the psychological sciences can either contribute to mental health or they can be exploited to divide and confuse mankind. It is only with a full awareness of these and other obstacles that we can do our work with any prospect for success. There is, however, all the difference between recognizing that a task has immense difficulties, and insisting that it is impossible.

This then, as we see it, is the ultimate goal of mental health—to help men to live with their fellows in one world.

The *Statement*, which was adopted by the Congress, includes a considerable number of recommendations to be sent on to United Nations and to their specialized agencies, UNESCO and the World Health Organization. It is satisfactory to learn that action is already being taken by these agencies on a number of suggestions put forward by the Congress.

### 4. Other Activities

While the whole Conference was discussing this main theme through its small international groups and in plenary session, a considerable number of meetings was held in various parts of London, designed for those with special interests in certain branches of psychiatric and mental health work which were not specifically related to the main theme.

*Continued at foot of page 7*

<sup>2</sup> [The *Statement of the International Preparatory Commission* has been reprinted as a pamphlet and is available (price 1s. in Great Britain) from H. K. Lewis & Co. Ltd., 136 Gower Street, London, W.C.1, or from mental health organizations in other countries.—Ed.]



## PSYCHOLOGY AND MENTAL HEALTH

### Current Trends and their Implications

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- 1 A remarkable change
- 2 Experimental developments
  - a Problems of display and control
  - b Problems of continued exercise
  - c Problems of tolerance limits
  - d Problems of incentive and motivation
  - e Problems of ageing
  - f Problems of special disability
- 3 Clinical developments
  - a Tests
  - b Questionnaires, opinion studies and surveys in general
- 4 Implications
- References

For generations the impact of medicine on psychology was almost exclusively clinical and in the main confined to the use of psychological ideas and methods for the diagnosis and treatment of mental disorder. It was considered right and fitting that the medical student, if he learned any systematic psychology at all, should have his introduction to this subject at a late stage of his training, and by direct contact with patients in hospital or in private practice.

#### 1. A Remarkable Change

The last eight or nine years have seen a very great change. The view expressed above is now, almost everywhere, regarded as unsound and unnecessarily biased. In this country every authoritative report on medical training which has lately been made public has insisted upon the necessity for the provision of early teaching in psychology

for all medical students. Moreover it is recognized that such teaching ought to be essentially scientific and as far as possible experimental, and that it should be accompanied by a reasonable instruction in the use of statistics.

More immediately important still, perhaps, the range of psychological research and investigation in regard to mental health problems has been enormously extended and their directing ideas revolutionized. No longer does the mentally defective individual, the psychopath, or the eccentric attract almost exclusive attention. By far the greatest amount of effort is devoted to the establishment of scientifically attested knowledge about how to keep the normal person healthy in the face of all the strains and stresses of modern life which he must inevitably meet. It now seems clear that mental health is something that should be established and preserved, and not something to be broken down and then re-established.

Many influences have contributed to this striking change. The temper of the times is predominantly scientific. Everybody recognizes that man's greatest triumphs in the world of nature have been won by the development of exactly controlled methods of observation and experiment. At the same time it is universally acknowledged that control over nature may be used as readily to man's disadvantage as to his advantage. It no longer appears sensible to try to counter this difficulty by speculative theory, or to allow the disadvantages to occur and only then to try to deal with them. The same methods that have been used to extend man's power over materials must now be used in an effort to direct his enhanced opportunities, not only so as to avoid individual and social breakdown, but positively to promote human well-being.

More specifically, many of the most outstanding applications of scientific invention and discovery during the Second World War led to an enormous increase in the use of machines of all sorts. These set their operators new problems and imposed upon them new strains, often of a very severe nature. To solve the problems and alleviate the strains there grew up a new type of scientific investigation known generally as "personnel research", of which the best summary published account is in a Medical Research Council report (1947)<sup>1</sup>. The broad aim of this type of work was to control the design of instruments and to direct the conditions of their operation so as to bring both as completely as possible within the range of variations of the normal bodily and mental equipment of the operators.

<sup>1</sup> [See also *British Medical Bulletin*, 1947, Vol. 5, No. 1, symposium: "Some problems of personnel research."—Ed.]

#### MENTAL HEALTH CONGRESS

*Continued from page 6*

These meetings were for the most part very successful and stimulating, and without doubt some members found it a relief to get down to the discussion of a more localized and concrete topic after the effort to encompass the main theme with its vastness and urgency.

There were other activities in progress also. The delegate meeting of the Child Psychiatry Conference resulted in the formation of an International Association for Child Psychiatry (President, Dr. Frederick H. Allen of Philadelphia), whilst the delegate meeting called by the International Committee for Mental Hygiene met at the Ministry of Health and launched a World Federation for Mental

Health, which has, since the Congress, been accepted as a non-governmental body with consultative status by both UNESCO and the World Health Organization.

#### 5. Results of the Congress

If one may therefore sum up the work carried through in London last August and through many months preceding, one might say firstly, that a stimulus has been given to interprofessional team work for mental health; and secondly, that certain new concepts have begun to be formulated as to the contribution that psychiatrists and social scientists of all types may hope to make towards the solution of the wider prophylactic problems in the field of mental health. It remains to be seen whether the hard work put in by so very many people will produce recognizable results in the future.

Within reason it was remarkably successful and it is the continuing influence of this movement for "personnel research" which has very largely brought about the new direction of approach to problems of mental health in civil life.

At the same time the swift growth of experimental medicine, particularly in the fields of chemotherapy and nutrition, the emergence of the rather inaptly named "social medicine", and the specific development, especially in Great Britain, of industrial medicine have played exceedingly important parts in effecting the same change of attitude. Moreover the astonishing results of physical methods of treatment of certain rather desperate forms of mental disorder have certainly had not a little to do with the present active exploration of experimental technique in the study of mental health. These influences have securely tied up with medical science a movement which, without them, could quite easily have been treated as a specialized branch of experimental psychology alone.

Even a brief and general survey such as the present one would be incomplete without reference to influences spreading from the "mental test" movement. From very early days there have been prominent psychologists whose principal interests have lain in the development of methods for the study of individual differences. Some of the most effective contributions have been made by English-speaking investigators, especially in Great Britain, through the pioneer work of the late Professor C. E. Spearman, of Sir Cyril Burt and of Professor Godfrey Thomson. These have in practice issued in the belief that for most, if not all, of the vocations available in a modern society there is what may be called a "fit" mental and bodily constitution. Tests, which are essentially diagnostic and prognostic devices, are designed to indicate, and perhaps to measure, this fitness. They can then be used in the service of mental health both to select fit people—who will thus be the more likely to retain normal health as they pursue the vocations for which they have been chosen—or to diagnose the nature of "unfitness", and to effect a reasonably exact prognosis at any stage of treatment. The test development, grown now to tremendous size, has had considerable repercussions on the more traditional clinical aspects of the study of mental health.

This is the general contemporary setting as it is to be found in Great Britain. Let us now consider a few specific illustrations of current trends.

## 2. Experimental Developments

### *a. Problems of Display and Control*

A very large proportion of the population of any large modern state is concerned with the day-to-day manipulation of machines of some kind. The operator of every machine is set two classes of problem. He must be able to interpret, within limits of accuracy and usually at speed, the signals for action which the machine gives, and he must be able to manipulate the controls which are provided. If the signals are badly designed—small or excessively large, crowded, ill-shaped, inconveniently timed, awkwardly placed, easily confused with others—the operators will suffer unnecessary strain, the cumulative effects of which are very likely indeed to produce accidents, dissatisfaction and anxiety, troublesome and avoidable fatigue, and, it may be, various forms of specific or general disease. All these and many other of

the variable characters of signals for action constitute problems of display. They obviously invite an experimental approach which will set out to discover the normal limits of variability of the human activities involved that are consistent with their efficiency in continued exercise. If the work signals can be designed to lie within those limits one of the necessary steps towards restricting the chances of mental ill health in the ordinary citizen will have been taken.

Precisely similar problems arise in the case of machine controls. Many designs of controls which are entirely satisfactory from an engineering point of view present very great difficulties to the operator. A solution of problems of display demands a much more firmly based knowledge than we have at present about the basic activities of the special senses, especially in relation to one another, and of the associated processes of human judgement. To solve the parallel problems of control we need fundamental experimental studies of the nature of bodily and mental mechanics.

The great bulk of the possible applications of these ideas to civil and peacetime occupation has yet to be worked out. But the methodology and the broad problems remain the same in peace as in war and already much has been learned about display and control for the airman, the sailor, the navigator and for many kinds of operations which involve the tracking of targets. Various organized groups of workers in Great Britain are now actively attempting to approach the many pressing peacetime problems in this field. (Cf. Craik, 1944; Fitts, 1947; Morgan, 1947.)

### *b. Problems of Continued Exercise*

People get tired. There is no doubt about that. When they do, it is usually considered to be either because they have to keep on doing the same things over and over again for long periods, or, also for long periods, they have to switch from one thing to another without rest. This is much more doubtful. The precise study of the changes in human activity which may be traced to the continued exercise of that activity has always been of psychological importance, but never more so than now. For it has become a matter of popular belief that fatigue is both inseparable from modern conditions of life and work and also is a potent cause of mental ill health. It seems as if the increased speed of modern life, largely consequent upon the widespread applications of scientific invention, its enormous and often narrow specialization, and the tremendous amount of planning, which has the effect of making routine the daily activities of immense numbers of people, all increase the liability of the general population to fatigue.

It should be more widely known than it is, that there is much evidence that—always excepting work involving heavy and continued muscular effort, and providing that working conditions (including display and control) are devised with a proper regard for what most folks can do readily—work can be continued for very long periods indeed with no bad effects whatsoever, either immediate or remote. If, in special cases, it can be shown that relatively light work does produce hampering fatigue, it is almost certain that this is due to faulty design and in particular to some form of accumulated anxiety which goes with this. All these are topics of very active current research; further discussion is given by Davis (1948).

*c. Problems of Tolerance Limits*

It is a reasonable hypothesis that for almost all directions of human activity there are limits of toleration, both environmental and internal, the persistent passing of which leads to mental trouble. All regularly exercised human functions have been built up in a world of change. Even wide changes within limits impose no important variations in the efficiency or ease of work. But outside these limits small changes may mean big deteriorations. Moreover, in spite of individual differences, the limits remain remarkably consistent for all healthy individuals, given the adaptation which is secured by appropriate training and exposure. For example, a wide range of human functions begin to break down badly at an effective temperature of some 85 to 90° F. There are similarly determinable limits of tolerance for cold, for speed of work, for numbers of operations requiring simultaneous regard, and for many other conditions. To know where these limits are set, and to what extent they can be safely ignored when special spurts are required, are two of the principal practical concerns of current studies undertaken in the interests of mental health (Mackworth, 1948).

*d. Problems of Incentive and Motivation*

Everybody recognizes that the maintenance of health, both bodily and mental, depends largely upon the reasonable exercise of a wide range of normal human functions. Such exercise will not usually be undertaken in the absence of adequate prompting and directing conditions, external and internal. Broadly, the external prompting conditions are regarded as belonging to the order of incentives and the internal ones to that of motivations.

Beyond question much in the study of incentive and motive lies outside the experimental field at present. In particular the incentives and motives of practical life have an urgency which it is very difficult to reproduce under experimental conditions. But it is probable that the ways in which they operate and the general methodology of their study do not change directly with their intensity. Already, for example, it has become clear that experiment can contribute valid and important evidence about the characteristic ways in which forms of encouragement and discouragement (including specific rewards and punishments) operate; and about the effects of targets of performance, definition of tasks, competition, and even particular types of leadership. Further, current experiments are throwing much light upon those widely applicable motives which depend on a knowledge of the results of performance, and upon signals provided during performance which indicate the difference between what is done and what is desired to be done. Especially the limits of incentive and motive are being worked out: the difference between those that produce spurt results and those that maintain persistent improvement or deterioration; the relation of both to tolerance limits; and how and why both have their most marked effect upon performers who, even without them, show the greatest relative efficiency. In one way and another it seems certain that one of the most fruitful current trends is that which may lead to the clarification, by controlled methods, of the many problems of incentive and motive, and to a sound knowledge of how these influences work.

(See Elwell & Grindley, 1938; Carmichael & Dearborn, 1947; Mackworth, 1947.)

*e. Problems of Ageing*

Nearly every civilized community is now facing the very serious problems of mental health which are associated with a steadily increasing average age of its working population. The outstanding questions which demand well-founded answers are:

- i. What are the characteristics of the continued exercise of skill, with or without muscular effort, which mark advancing age?
- ii. Within what chronological age-ranges do these changes first become significant?
- iii. What methods can be developed which will show not only the level of over-all performance of whatever skill is selected for study, but also the level of performance of its constituent items, and their internal relationship?
- iv. Are satisfactory methods of training (or of re-training) different for different age-ranges if the main criterion is the avoidance of dangerous mental strain? (The current approach here characterized to problems of ageing is best represented by the work of the Nuffield Research Unit of the Psychological Department of the University of Cambridge. Published reports of this will be available in the near future.) (Cf. Welford, 1949.)

*f. Problems of Special Disability*

Finally, in the general experimental field, there is a marked increase in the study of special disabilities. This is due, in the main, directly to developments of industrial medicine and of education. The former has greatly stimulated the investigation of psychological aspects of specific industrial diseases, with emphasis upon prevention and rehabilitation. The latter has led to a rapid growth of research into the psychological concomitants of partial disablement, especially of deafness and blindness in children.

**3. Clinical Developments**

Only a very biased view could pretend that any but a limited range of mental health problems can at present, or perhaps ever, be solved by controlled experimental procedure. Clinical and experimental methods have, in fact, to be developed side by side.

*a. Tests*

Tests are essentially diagnostic and prognostic devices. By them we attempt to find specific situations, performance in which will, within limits of statistical validation, predict the most probable performance in different but more or less related situations. Their function is exactly that of other diagnostic signs used by the medical man except that they aspire to an objectivity of scoring and interpretation which sets them as free as possible from any idiosyncrasies of the clinician.

Psychological tests for mental health purposes are being widely exploited now in three main directions. First,

on the assumption that people will be more healthy if they do the things for which they are by constitution most fit, to select them for their vocations in life. Successful as this enterprise frequently is, it is by no means the simple task that it is often supposed to be, or that it is frequently made to appear. In particular the follow-up procedures, which alone can justify the wide application of tests for this purpose, are still very much in their infancy. Second, psychological tests are used directly to clarify and assist the diagnosis of mental ill health, and to help prognosis at any stage of treatment. In this function they determine the main activities of the clinical psychologists who are, to an increasing extent, accepted as regular members of medical units attached to hospitals, clinics and special schools. Third, in conjunction with developments of statistics, psychological tests are being used in an attempt to carry out fundamental analyses of the human mental constitution and to detect the number and interrelations of its contributory elements. This is a very highly technical study, requiring far more critical insight and knowledge in regard both to the collection of data and to the selection of appropriate statistical methods than are commonly either realized or appreciated.

#### b. Questionnaires, Opinion Studies and Surveys in General

A great many problems of mental health depend upon the relation of individuals and groups of individuals to their social and cultural backgrounds. What, for example, is the precise effect of different systems of industrial management, of joint consultative bodies and the like? What are the differential results of different working shift systems, or of popular beliefs about wages, or promotion, or leisure time and its activities? Why are there unwanted occupations, and what are they? How does the enormous speed of mass intercommunication in the modern world affect public and private stability? There is almost no end to the questions of this kind that can be raised. In most cases experiment can hardly touch them, or can offer only very dubious and long-term results indeed. To deal with them, a very large variety of devices, such as questionnaires, opinion studies and social surveys, has been put forward and used. Most of these grew up in the USA but they are rapidly travelling to every large social group and they

represent a strong current trend in Great Britain. They involve far more, and more complicated, difficulties than can be discussed here. All that can be said is that they are often associated with promises which greatly outrun any reasonable chance of early achievement. While no fair-minded review of present tendencies can dare to neglect their rapidly growing importance and value, they are singularly unsuited to exploitation by people with little and superficial training who are on the look-out for quick results. Of the extensive literature available on these general topics, the most useful methodological book is edited by Cantril (1944), and a more comprehensive and theoretical treatment is made by Cantril & Sherif (1947).

#### 4. Implications

Any summary statement of the implications of these and other current trends in the psychological study of mental health must be tentative and hypothetical. It is extremely likely that results will differ from one social group to another and they will of course be partially determined by events which nobody can yet foresee. There is for example sharp cleavage of opinion between those who predict that mental health will remain the concern of the qualified medical man, though with specialized and far more scientifically directed psychological training than he has ever received in the past, and those who predict that the psychologist as such, without what is now regarded as the essential medical qualification, will become an indispensable member of every medical unit, with status and reward in all respects equivalent to that of the doctor. On the whole the latter appears to be the present trend in the USA and the former in Britain; but not unequivocally in either case. What is already sufficiently certain, in this country, is that the medical man of the near future will have a psychological training more scientifically directed, earlier, more persistent, and eventually, in suitable cases, far more broadly specialized than has ever been the case before. And at the same time all lively centres of psychological teaching and research will be forced to study problems and methods that will take them far beyond the confines of the lecture room and laboratory into the daily life, activities and aspirations of people everywhere.

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## EDUCATIONAL PSYCHOLOGY: ITS IMPLICATIONS FOR MENTAL HEALTH

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- 1 The development of educational psychology as a science
- 2 The application of experimental and statistical techniques
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- 4 Diagnostic methods
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Educational psychology falls into two main branches—the study of the mental differences between individual children and the study of the effects of different methods of training. Of these two branches the former has made the greatest progress, and possesses the most obvious implications for mental health. But the latter has given rise to numerous important researches, and has led to several unexpected discoveries. The distinctive characteristic of both branches consists in the scrupulous adoption of scientific techniques in place of the old-fashioned reliance on personal experience, traditional precepts, and unaided common sense.

For the most part the problems attacked and the methods employed have been dictated by practical needs. It is therefore hardly possible to appreciate the special contributions made by educational psychology without knowing something of its history.

### 1. The Development of Educational Psychology as a Science

Down to the closing decades of the 19th century, the psychology of education, like other applications of psychology, was regarded as proceeding essentially by deduction. Mill, for example, championed the view that the study of the mind was a department of natural science rather than of philosophy; but at the same time he insisted that experimental methods were unsuited to it (cf. Mill, 1856). The right procedure, so he declared, was “to formulate generalizations on the basis of common obser-

vation, and gather these into a consistent body of knowledge”. Admittedly, the knowledge so gained would be “only probable knowledge, not certain knowledge”. But, owing to the immature state of the ‘science of probability’ (or ‘statistics’ as we should now call it), little help could be expected from this direction.

It is amazing that Mill, the apostle of induction, should have entertained so sceptical a view of the possibilities of psychology as an inductive science. Yet, down to about forty years ago, when Stanley Hall’s *Adolescence*, Claparède’s *Pédagogie expérimentale* and Meumann’s *Experimentelle Pädagogik* appeared in quick succession, nearly every textbook on educational psychology was written in accordance with Mill’s principles. And his mode of approach is still commonly adopted in discussions of psychological problems by medical and educational writers who have had no training in modern psychology, and are therefore unaware of the rigorous techniques that are now available for verifying or refuting the conjectural inferences of the impressionistic observer.

### 2. The Application of Experimental and Statistical Techniques

The change began with the revolutionary proposals of Sir Francis Galton (1874, 1883). Galton held that individual psychology was “a self-subsistent department of anthropology—the science of man”. “It has”, he observed, “profound implications for philosophy and medicine, but is not itself a section of either.” As a science, it should, he argued, be treated as an inductive, not a deductive, branch of knowledge; and he set himself to demonstrate the applicability of both experimental and statistical procedures to its various problems. The direct result of his labours was the invention of experimental tests for assessing ‘natural ability’, and the introduction of mathematical devices, like the normal curve and the correlation coefficient, for standardizing and validating the results of such tests.

The implications of Galton’s work for education and for mental hygiene can hardly be better stated than in the words of one of Galton’s most eminent followers, William McDougall. “The corollary for the teacher”, he says, “is obvious. He must in future think less of the subjects he is teaching and more of the individuals whom he is endeavouring to instruct. The first essential is to discover the limitations imposed at birth by the child’s innate constitution; and the next is to adapt the system of instruction to the child’s capacities, not the child to the system of instruction. Only in that way can we hope to improve the intellectual efficiency, the mental health, and the moral well-being of the nation. Moreover, to do this with understanding, we must lay the foundations in an accurate knowledge of the mind of the growing child. As Galton has himself pointed out, no one can do this so well as the teacher; nowhere can it be done so readily as in the school.”

Indeed, Galton, as Pearson has remarked, “looked upon the school, not merely as an institution for educating the young, but as a laboratory for studying their mentality”. Galton himself observed: “As every hospital fulfils two purposes, to advance pathology as well as to relieve the sick, so every school might be made to fulfil not only the primary purpose of educating boys, but also the more urgent task of



promoting the science of education. Schools are ideal places for experimental and statistical inquiries."

Largely at the instigation of Galton, and with the willing co-operation of leading teachers, inspectors, and education officials, James Sully, Professor of Mental Philosophy at University College, London, founded in 1894 the Child Study Association. Its objects were "to encourage the scientific study of the individual child and the application of psychological methods to the problems of childhood, education, and school hygiene". In this way the child guidance movement was launched; and, thanks to the sympathetic assistance given by the Education Officer for London, Sir Robert Blair, and the Chief Inspector of Schools, Dr. C. W. Kimmins, it rapidly became a reality.

### 3. The Study of Individual Differences

The first step, in Galton's opinion, was for the teacher to make a systematic study of the capacities, needs, and limitations of every individual child. "By developing his potentialities to the utmost, and in the direction that is most natural, we shall not only make the most of our human resources, but avoid the fatigue, the strain, and the breakdown that is now so common in our schools." With this aim in view he drafted a school record-card. This was to be filled up for every pupil first on entrance and then on 29 February of every leap year. Its object was to exhibit in accurate and comparable form the physical, medical, mental and educational characteristics of each child, and his development and progress throughout the years of growth.

Children who were found to be "persistently backward, or showed signs of nervous strain or moral defects" were to be referred for fuller and more expert examination at a central office, such as the 'anthropometric laboratory' he had established. In London, for example, teachers began to refer their more difficult cases to inspectors with a psychological training, like Ballard and Winch, and were later instructed to nominate dull and backward pupils for possible admission to a special class or special school.

### 4. Diagnostic Methods

At the beginning of the present century, both teachers and school medical officers thought and wrote in terms of the old-fashioned 'faculty-doctrine', particularly in the form given to it by the phrenologists, who in Great Britain achieved a wide popularity during the 19th century; and when systematic research in educational psychology was first started in Britain, mental deficiency and 'moral imbecility' were still regarded as symptoms of organic defects affecting more especially the central nervous system, and revealing themselves by physical signs. Binet and Galton themselves began with the view that intellectual and moral qualities could often be inferred from bodily characteristics. As a reference to contemporary textbooks on mental deficiency will show, the diagnosis of deficiency in cases referred to medical officers for possible certification was based partly on an assessment of the size of the brain (usually by measuring the circumference of the skull) and partly on an inspection for anatomical 'stigmata' (especially the physical signs of the clinical types). The idea of measuring mental abilities by mental tests was considered to be at once impracticable and far-fetched. Even the

most enlightened writers on the subject held that at the very best "the applicability of the methods of the psychological laboratory would be exceedingly limited", and that they were "unsuited for use in the consulting-room or for diagnosing the conditions dealt with" (cf. Tredgold, 1914).

As a result of the methods then in vogue the special schools were filled partly with a small proportion of low-grade cases of well-recognized types, many of them ineducable imbeciles, and partly with a large number of retarded children who, in the view of teachers and magistrates, were not mentally defective in the technical sense. Indeed, after two or three years of training, a considerable proportion were actually returned to the ordinary school as 'cured'. Parents complained of the stigma, teachers of the mixed classes they had to deal with, and the education committee of the expense. Eventually in 1913 the London County Council appointed an educational psychologist, as a member of the school inspectorate, to deal not only with this particular difficulty, but with any psychological problem arising out of the work of the schools.

An incidental result of this appointment was that many London schools became what Galton had desired—laboratories for the systematic investigation of educational problems by scientific procedures. Research students, who had been trained at one of the departments of psychology of London University and who were themselves as a rule teachers of some experience, co-operated with the Council's psychologist in carrying out a long series of educational investigations. Thus gradually a fairly comprehensive scheme of child guidance was built up.

### 5. Classification

In the early days of this work, interest chiefly centred on the discrimination of the subnormal. The first problem therefore was that of classification. The faculty-doctrine had brought with it the doctrine of discrete types; and the medical and legal definitions of 'mental defectives' and 'moral imbeciles' were expressed in terms of the type-doctrine: each group was supposed to consist of a distinct and clearly recognizable pathological class. On the other hand, academic psychology was strongly opposed both to faculties and to types; and early work with mental tests seemed at first to support its objections.

Once again it was Galton who indicated the solution. Although the alleged types overlap and merge into one another without any clear lines of division, this does not prevent us from accepting a classification according to complex patterns or tendencies. Accordingly, following out Galton's suggestion, Pearson (1902) proposed a statistical technique for investigating the 'index characters' or 'syndromes' on which a working classification could be based.

*Factor-analysis*, as this technique has since been called, has thrown a flood of light on the structure of human personality, and has produced a convenient scheme or schedule for investigating the characteristics of any individual personality—whether subnormal cases needing educational guidance, like the backward, neurotic, defective, or delinquent; or normal or supernormal cases put forward for vocational guidance or allocation to particular types of school.

Broadly speaking, mind or personality is regarded as being composed of both 'general' and 'specific' factors, not unlike the mental *genera* and *species* of the schoolmen. Of the general factors, the most important are (i) the factor of innate general intellectual ability, usually called intelligence, and (ii) a corresponding factor of general emotional instability. On the cognitive side, the specific or group factors include (a) *formal* factors like perception, memory, reasoning, and the like, and (b) *content* factors such as the verbal factor, the numerical factor, the spatial factor, and the various factors underlying imagery of different types (visual, auditory, kinaesthetic, and so forth). So far the scheme agrees admirably with the doctrine of a hierarchy of nervous levels as taught by Hughlings Jackson (1899), Sherrington (1906), and Head (1920). On the emotional side the chief group factors point to a classification not unlike that embodied in the traditional theory of temperaments. The so-called temperamental factors are thus responsible for physical, physiological, and biochemical differences, as well as for differences in disposition and character. The notion that emotional types can be determined from body-build—a notion widely popularized by the followers of Kretschmer, Berman, and Sheldon—has been shown to contain an element of truth. The correlations are usually positive, but are much too low for practical use.

## 6. Causes

Early work on subnormal children directed attention mainly to those causal influences that were at once conspicuous and amenable to treatment. Social reformers stressed social conditions, school doctors physical conditions. Reports of Care Committees emphasized the ill effects of poverty, overcrowding, lack of cultural opportunities; medical officers' reports pointed to the frequency of malnutrition, infectious fevers, septic tonsils and adenoids, defective sight and hearing, disturbances of the endocrine glands, and alleged organic defects of the nervous system (congenital lesions of the brain, chorea, epilepsy, petit mal, and the like). Pearson and the eugenists have argued in many publications that these had comparatively little influence, and that the child's heredity was chiefly to blame. The psychoanalysts agreed in minimizing the importance of organic and economic conditions, but placed the chief weight on unconscious emotional factors developed during early childhood.

Such controversies could be solved only by careful statistical inquiries. Psychological work has amply demonstrated that, although physical and economic conditions may play their part, the main determinants are mental. Multiple causation is the general rule. Different causes are responsible in different cases; and nearly always not one influence but a number are at work.

## 7. Inheritance of Mental Characteristics

What the educationist wants to know, first of all, however, are the innate characteristics of each pupil, and how far the child's inborn or inherited limitations are likely to defeat or to restrict the effects of education. The investigation of heredity has proved far more complex than was originally supposed. The majority of traits appear to follow a multi-factor inheritance; a few defects seem due to uni-factor

inheritance. There is now little question that the general factor underlying cognitive efficiency is in the main inherited, or (as the geneticist prefers to put it) "attributable to the potentialities of the child's genetic constitution". Hence intelligence is now commonly defined as innate, general, cognitive efficiency. However, although the aim of intelligence testing is to measure the child's innate ability, it cannot do so with absolute precision; and (contrary to common opinion) no competent psychologist trusts merely to a mental age or I.Q. as obtained with the Binet scale or with written 'group tests.' The family history and the child's early development have always to be explored before a diagnosis of mental deficiency can be safely pronounced in any doubtful or borderline case; and a full course of training is essential before the practical psychologist can venture to apply and interpret such tests in individual cases.

In spite of the strong opposition put forward by Spearman (1927), much evidence has been accumulated to show that many special abilities and disabilities may be, in part at least, innate. Nevertheless, in most cases, provided the child's intelligence is normal, the majority of the difficulties can be compensated for, or overcome by appropriate methods of training.

The factor making for temperamental instability ('general emotionality', as it is commonly called) appears also to be largely innate, and is no doubt responsible for the notion of a 'neuropathic diathesis' described by many medical writers. In the older medical textbooks on mental deficiency, a condition called 'moral imbecility' was also recognized, and attributed to an innate deficiency in the so-called 'moral sense'. A similar conception formed the basis of Lombroso's theory (1907) of the 'born criminal' (*il reo nato*). Later investigations have indicated that such a view is exceedingly misleading. There is no such faculty as the 'moral faculty' or 'moral sense'. Morality and criminality are acquired. Criminal habits and moral defects, like intellectual backwardness and educational deficiency, are due to a large number of differing causes. Indeed, temperamental characteristics seem even more amenable to environmental influences, whether for good or for ill, than intellectual characteristics.

## 8. Mental Tests

Standardized tests are now available for measuring the mental and scholastic abilities of boys and girls at every age of their school career. In the interests not only of the community, but also of the individual himself, it is essential that each child should be educated according to his aptitudes and needs. Psychological tests have consequently been employed, not merely to diagnose cases of certifiable deficiency and to pick out the dull and backward, but also to discover the bright and the supernormal, and the pupil with exceptional gifts or talents. In London from the earliest years the work of the educational psychologist was concerned with devising reliable means of allocating older pupils to schools of special kinds—secondary (or 'grammar') schools, central schools, trade schools, arts schools, and other types of commercial or technical institute. This has led to ingenious suggestions for measuring verbal ability, mechanical aptitude, artistic capacity, and the like.

The success that attended the construction of intelligence tests has encouraged psychologists to try devising analogous tests for temperamental and moral qualities, or, as they are sometimes termed, 'personality traits'. Measurements of physiological characteristics—pulse, blood pressure, cutaneous circulation, metabolism, differences in autonomic activity and endocrine secretion—have so far proved disappointing. The paper and picture tests, so popular with amateur psychologists in all professions, have proved to possess very little diagnostic value in individual cases. In spite, therefore, of the claims of test-enthusiasts, most psychologists of wide experience and scientific caution seem agreed that a modified interview-technique, supplemented if possible by reliable reports and by observation of actual behaviour in standardized situations (e.g., in a playroom with other children, or at 'house-parties'), is still the most satisfactory method for assessing 'personality', and far more trustworthy than any formal tests that have hitherto been devised.

### 9. The Psychology of Training

Education, as the word itself implies, consists essentially in the attempt to develop, deliberately and systematically, the various potentialities of the growing mind. A psychological account of the different methods or techniques available for training the child at school has always formed a large and important part of professional courses for intending teachers; and it was therefore not surprising that, with the introduction of scientific procedures into psychological research, the educational psychologist should set himself to investigate, by experimental or statistical means, the relative efficiency of existing methods of teaching and to devise new and more successful methods.

Experimental psychology, not unnaturally, concentrated first of all on the lowlier and simpler mental processes of sense-perception and movement. This work had a strong influence on classroom practice, especially at the earlier ages and lower mental levels: observation and manual activity began to play a much larger part in the work of the infant departments and of the special schools and classes for the backward or defective. Towards the close of the 19th century, however, an endeavour was made, with considerable success, to apply experimental methods to higher mental processes, such as memory, association, reasoning, and indeed all forms of learning. Much of this work has been done with the needs of the schoolroom definitely in mind; the outcome has been the accumulation of an increasing body of knowledge on such topics as the most economical methods of memorization, the best ways of teaching children the elementary school subjects, the nature, causes, and signs of mental fatigue and mental strain, and the general principles of mental hygiene.

The Child Study Society did much to sponsor experiments in what used to be called 'free discipline' methods—the Montessori method, the Dalton plan, the project method, the play-way, and 'new commonwealths' for young delinquents. As Chief Inspector of London Schools, its most active member, Dr. C. W. Kimmins, was able to encourage and facilitate actual trials in ordinary schools. The Freudian doctrine of the dangers of 'repression', the interest shown by educationists in different schools psychoanalysis, still further fostered this trend towards

freedom, and served to remind the teacher that the child's mind has its emotional and its unconscious aspects as well as the conscious and intellectual.

### 10. Special Disabilities

Considerable research has been undertaken on the training of children suffering from general or specialized disabilities. The devices for teaching the elements of reading and number, not only to infants, but also to the mentally defective, the dull and backward, and those suffering from so-called alexia, have been enormously improved as a result. No disability causes greater concern to teachers in the ordinary elementary schools than backwardness in reading, with its innumerable untoward consequences. Many school medical officers still hold that this may often be due to congenital word-blindness, congenital word-deafness, or a vaguer condition termed "congenital auditory imperception". Occasionally in the special schools or among children of pre-school age, cases are seen in which the implied explanation is highly plausible. In the ordinary elementary schools, however, as careful surveys have shown, genuine instances of this kind are practically non-existent. In the vast majority of cases where this diagnosis has been suggested the child can now be taught to read up to the level of his general intelligence, provided appropriate and up-to-date methods of training are employed.

The earlier work of the child guidance centres was indeed largely concerned with remedial work for children suffering from some form of special intellectual disability. More recently, special courses for teachers of backward classes have been instituted, where the newer psychological techniques can be acquired; and hence an increasing amount of such work can now be carried out in the ordinary classroom, with the occasional supervision of a visiting psychologist.

Not unnaturally, the school medical officer in the past has been tempted to interpret mental disabilities by analogies drawn from physical diseases. In a way that is half metaphorical and half literal, he speaks of delinquency, backwardness or emotional disturbances as 'mental illnesses'. Unless he has had some training in psychology he is not likely to realize how wide and how varied are the quite normal deviations shown by perfectly healthy individuals. One no longer reads medical reports declaring that 60 to 80 per cent of the juvenile delinquents in this area or that institution are feeble-minded. Actually the pathological types of mental deficiency and mental disorder are much more infrequent in children than is commonly supposed. The majority of cases referred to the educational psychologist and diagnosed as psychoneurotic or psychopathic exhibit no more than normal reactions to abnormal conditions. Psychotic and psychoneurotic conditions are undoubtedly found in children of school age. But the former are exceedingly rare before puberty, and the latter are by no means so common as is ordinarily supposed.

### 11. Emotional Disorders

Less success has been attained in dealing with emotional disorders. The psychiatrist, trained in a mental hospital, has in the past tended to interpret these in the light of conceptions acquired in dealing with mental disease in adults,

and promulgated by the particular school of psychological medicine to which he belongs. In this country it has not been easy to secure statistics to show what results are obtained with this or that type of treatment; but the evidence, so far as it goes, shows that the percentages of successes are much the same with all methods of approach. Indeed, what seems to be important is not so much the mode of treatment as the personality of the individual who undertakes it.

There is, however, a growing belief that what is chiefly needed is not so much treatment as training. So far as the child himself is concerned this will consist in a kind of re-conditioning. Undoubtedly the rare pathological cases will require something more, namely, psychiatric investigation and treatment in the narrower sense; but the majority of normal children will respond fairly well to what may be called emotional or moral training. Often this can be undertaken by intelligent parents or teachers, provided the psychologist in charge of the case knows what recommendations to make; in other cases the training has to be undertaken by the psychologist himself.

## 12. The Social Background

Too often, however, the medical approach has consisted in regarding the child as a case to be seen and treated solely in the consulting room or clinic, as though all the causes of his trouble lay within the child himself. To diagnose a case of diphtheria or of endocarditis it is necessary merely

to examine and consider the patient. But with mental conditions it is quite different. The psychologist has always insisted that to study and treat a personality in isolation from its environment—from the psychological 'field' in which his daily life is spent—is like trying to account for the oscillations of a magnetic needle without thinking about the magnetic field. This altered standpoint has an obvious practical corollary. In what are commonly called cases of 'personal maladjustment', the cause of the maladjustment may lie quite as frequently in the child's environment as in the child himself; and, when that is so, what has to be treated and changed is not so much the child as his social surroundings.

All this is now reflected in the fuller attention paid to the psychology of education in training colleges for teachers and in the institution or extension, within the education office, of departments dealing with the social aspects of child welfare. But teachers and social workers cannot cope unaided with every type of case. Hence centres or clinics are urgently needed where the more difficult type of 'problem child' can be dealt with—psychological centres for normal children who need merely individual study and special forms of training, psychiatric clinics for the rarer cases of definitely pathological type. Above all, these centres and clinics should, like the school system itself, be places for research as well as for individual treatment. Only by further research can our knowledge of the growing child and its varying needs be established on a sure and scientific foundation.

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## ASSESSMENT OF PERSONALITY

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- 1 Inventories and questionnaires
  - 2 Objective testing techniques
  - 3 Projective techniques
  - 4 Observational and sociometric methods
  - 5 Summary
- References

Psychologists define personality as "the integrated organization of all the cognitive, affective, conative, and physical characteristics of an individual as it manifests itself in focal distinctness to others" (Warren, 1934). Personality, in other words, is "the sum-total of the actual or potential behaviour-patterns of the organism, as determined by heredity and environment; it originates and develops through the functional interaction of the four main sectors into which these behaviour-patterns are organized: the cognitive sector (intelligence), the conative sector (character), the affective sector (temperament) and the somatic sector (constitution)" (Eysenck, 1947a). The cognitive and the somatic aspects of personality are dealt with in this number in the papers by Vernon<sup>1</sup>, and by Richter<sup>2</sup>.

We shall here be mainly concerned with the temperamental characteristics of the individual and the assessment of his character qualities, being careful to regard character not from the ethical point of view, i.e. as good or bad, but from the psychological, i.e. as strong or weak.

It is clear from these definitions of personality that it is impossible to make an "assessment of personality" as such, just as it is impossible to measure the universe. All we can do is to assess certain distinct traits of personality which are of scientific importance and then proceed to fit these together in order to build up as scientifically adequate a picture of the total person as can be done in the present state of our knowledge.

Assessment of traits has proceeded largely along four separate lines. These are: firstly, by means of inventories, questionnaires, and other pencil-and-paper tests; secondly, by means of objective tests of temperament and character; thirdly, by means of expressive or projective techniques; and fourthly, by means of observational and sociometric methods. These will be discussed in turn.

## 1. Inventories and Questionnaires

Questionnaires originated with the Woodworth Personal Data Sheet at the time of the First World War. Being

interested in measuring the trait of neuroticism in army recruits for the purpose of screening, Woodworth drew up a list of neurotic symptoms. The recruit was then presented with a list of questions such as: "Do you have dizzy turns?"; "Did you ever have a nervous breakdown?"; "Have you ever been off work through sickness a good deal?"; "Do you worry too long over humiliating experiences?", and so forth, and asked to encircle either a "Yes" or a "No" printed at the end of each question according to whether or not he had ever experienced, or was at present suffering from, this particular symptom. His score was the sum total of the symptoms endorsed. (Cf. Woodworth, 1922.)

Much work has since been done on neuroticism inventories of this type, and in certain circumstances they have been found extremely useful as screening instruments (Ellis, 1946; Symonds, 1931). Agreement with outside criteria, such as psychiatrists' ratings, is often quite high (Eysenck, 1947b). This type of inventory has been subjected to much criticism, mainly on the basis that a person can easily falsify his reactions, e.g. deny that he is suffering from a certain symptom in order to appear superior, or claim to be suffering from a symptom in order to "work his ticket", i.e., to obtain his discharge from the army, etc.

These criticisms have led to a rather more empirical method of construction of questionnaires. Starting out with two or more groups which we want to contrast, we ask them a large number of typical inventory questions (over 500 in the case of the Minnesota Multiphasic Personality Inventory Scale (Hathaway & McKinley, 1940; Meehl & Hathaway, 1946), and about 300 in the case of the Humm-Wadsworth Personality Scale (Humm & Wadsworth, 1934)); we then record the percentage of "Yes" answers to each question given by each group of persons, say, neurotics and normals, and then make up a scoring key for this particular trait, which takes into account only those items on which significant differences in responses are observed. Thus, when we find that neurotics differ significantly from normals in their answer to the question, "Do you worry about your health?" we do not conclude that neurotics actually do worry more about their health than normals—which is an inadmissible assumption—we merely say that they tend on the average to assert more frequently than non-neurotics that they worry about their health, and use this difference in frequency of assertion (which is an observed fact) as a basis of our interpretation of questionnaire construction.

This empirical method, since it makes no assumptions of veracity or otherwise, is clearly superior to the older method. It has moreover led to another advance, whereby we try to measure not only neuroticism or other closely similar concepts, but also a number of different personality traits, by the use of suitably contrasted criterion groups. As an example we may take the Humm-Wadsworth Scale, which gives scores for normal, hysteroid, manic cycloid, depressive cycloid, autistic schizoid, paranoid schizoid, and epileptoid types characterized, respectively, by self-control, self-improvement, inhibition, etc. (N); self-preservation, selfishness, crime, etc. (H); elation, excitement, sociability, etc. (M); sadness, retardation, caution, worry, etc. (D); daydreams, shyness, sensitiveness, etc. (A); fixed ideas, restiveness, conceit, etc. (B); ecstasy, meticulousness, inspiration, etc. (E). While far from perfect, this and the

<sup>1</sup> [BMB 1295.—Ed.]  
<sup>2</sup> [BMB 1300.—Ed.]



similar Minnesota Multiphasic Test are a great improvement on the long list of extraversion-introversion tests which were published in great profusion during the past thirty years or so, until it was found that introversion as measured by these tests was really nothing but neuroticism. At present, because of this demonstration, few people use extraversion-introversion questionnaires.

One other important contribution is made by the Humm-Wadsworth and Minnesota Scales. Recognizing that in spite of the empirical construction of the test, cheating is not ruled out, the authors have tried, in a variety of ways, to assess the amount of cheating present in a particular record. This can be done, for instance, by counting the number of times that a person denies the possession of undesirable qualities, on the assumption that no honest person could possibly claim to possess all the good and none of the bad qualities contained in the inventory. In other words, the person claiming too many good qualities is viewed with suspicion.

An alternative method is that of preparing a separate scale, consisting of items which are empirically found to be non-diagnostic with respect to the personality-variables included, but which are somewhat unfavourable to the person answering "Yes"; for example, "Have you ever told any lies in your life?" If too many of these questions are answered with "No", the honesty of the person filling in the questionnaire must be in doubt.

On the whole, it may be said that, when used with care, there is no doubt that questionnaires constructed along these lines, and embodying some of the safeguards mentioned, can give important and valid information about the individual's personality.

Other uses of questionnaires and inventories have been in the fields of attitudes and of interests. A person's attitudes are studied by presenting him with a long list of statements, such as, "Women are intellectually inferior to men", or "The death penalty should be abolished." He responds by agreeing or disagreeing with each statement in turn. This extremely simple method has led to much more complicated measuring devices, attitude scales, and so forth, which are discussed in detail by McNemar (1946), Cantril (1945), Murphy & Likert (1938), and others. Researches on them leave no doubt that attitudes play an important role in personality structure.

Interests are mainly studied from the point of view of occupational interests (Strong, 1943; Kuder, 1939; Lee & Thorpe, 1943), and of values (Allport & Vernon, 1930). Long lists of choices of activities, occupations, types of work, etc., are filled in by the subject and the results scored according to empirically derived keys, by contrasting them with typical response patterns of persons successful in different types of occupations. These inventories have been found very helpful in focusing vocational and other types of interests, and as an aid in vocational guidance when added to an assessment of the subject's abilities.

## 2. Objective Testing Techniques

Objective testing techniques are described in some detail in books by Hunt (1944), Greene (1941), Cattell (1936), Eysenck (1947a), and others. They usually attempt to measure a single trait such as persistence (Howell, 1933), accuracy (Hartmann, 1928), suggestibility (Hull, 1933),

or level of aspiration (Lewin *et al.* 1944; Himmelweit, 1947), by means of objective tests. A large-scale beginning of research in this field was made in the well-known studies of deceit, honesty, and so forth, by Hartshorne & May (1928). These authors devised a large number of tests of anxiety, co-operation, persistence, inhibition, and the like, which they applied to many hundreds of schoolchildren. Examples of some of these are the following.

1. *Double testing technique.* A test is given and the subjects score their own papers by means of a key; later on, they are tested again by means of an equivalent test but without being given a key. Large differences between the scores on these two tests indicate that the subject cheated by copying from the key.

2. *Improbable achievement technique.* The children are given complex tasks, such as tracing a maze with their eyes shut, which are found under control conditions to be extremely difficult or impossible. Success indicates that the subject cheated (e.g. opened his eyes).

3. *Fictitious test technique.* The examinee is given a test, in which some of the questions or items are fictitious. For instance, he may be asked to mark all the books he has read on a long list which includes a large number of non-existent books. Any claim to have read these books is, *ipso facto*, evidence of deceit.

4. *Stealing tests.* The testing situation is arranged in such a way that the subject is given an opportunity to abstract some coins, apparently without any possibility of detection. However, by means of an inconspicuous identification symbol it is possible to find out which subjects have stolen some of the coins.

5. *The vote test.* Children in a class are given a money-prize for some activities in which they have been engaged. They are then asked to vote what to do with the money, which can be used either for certain selected persons in the group, for the group as a whole, for the school of which the group is part, etc. Answers are scored according to the degree of social-mindedness indicated.

6. *The helpfulness test.* An appeal is made to the children for pictures and books to give to children in hospitals. The number of items contributed by each child is his score.

7. *Persistence test.* One measure of persistence is derived from the speed of work of the child when employed for an hour at a monotonous task. Another involves the reading of a story printed in jumbled type, necessitating much effort and attention; the child is allowed to stop at will and is scored on the length of time he kept on with his task. Much evidence is given by the authors of these tests about the reliability and validity of these measures and their inter-relations.

As another example of a rather simple type of objective test we may take the trait of suggestibility, which can be measured objectively in a variety of different ways. In the body-sway test, for instance, the individual is told to stand still with his eyes closed and to listen to a gramophone record which the experimenter is going to play to him. The amount of body sway forward and backward during the initial period is noted; then the record is played, which repeats with slight variations the phrases, "You are falling; you are falling forward; you are falling forward all the time; you are falling forward now," etc., and the effect of the suggestion on the amount of body sway of the subject is

measured in inches. Some people are found to be very suggestible, even to the extent of falling outright, others sway but do not fall, and some are quite immune to the effects of the suggestion. Tests of this kind may be interesting in themselves, or they may be interesting additionally because they serve as measures of something other than themselves. This particular test, for instance, is of interest in its own right, but it is also important because it shows a very high correlation with neuroticism (neurotics tend to be very much more suggestible than normals on it) (Eysenck, 1944); and it also correlates highly with the subject's hypnotizability (suggestible persons are very much more easily hypnotized than others) (Eysenck, 1943).

As one further example of the straightforward test we may mention the "level of aspiration" technique, in which the subject is called upon to perform a task such as, for instance, threading a rather complicated maze. After he has gained some acquaintance with the task he is asked to state how long he thinks it will take him to carry out the task the next time he attempts it. This is called his "aspiration score". He then is given the test and his "performance score" is written down; but before telling him what his performance score actually is, he is asked to say how long he thinks he took over his task. This is called his "judgement score", constituting as it does his judgement of his own previous performance.

Difference between aspiration and actual performance and between judgement and performance are highly instructive, as they indicate the influence of autistic and emotional factors on what otherwise would be a purely rational estimate. It can be shown, for instance, that hysterics tend to have a low level of aspiration; that is to say, for hysterics, the aspiration score is no higher than the actual performance. For normal people, the aspiration score is typically somewhat higher than their actual performance. For neurotics suffering from anxiety states, the aspiration level is typically very much higher than their actual performance. At the other end, the typical anxiety neurotic tends to underrate his performance, his judgement score being much lower than his performance score. A normal person has a judgement score relatively close to his performance score, while the hysteric on the average actually tends to overrate his performance and to think he has done better than he has in fact done. These are some of the ways in which this particular test discriminates between groups who differ considerably in personality make-up.

The tests mentioned so far attempt to measure directly certain personality traits. It has, however, been found that certain types of normal and abnormal people can be differentiated on another basis which derives from purely empirical investigation. The group of tests to be discussed here is similar in many ways to ordinary tests of ability. The difference lies in the fact that we are more interested in differential ability scores as measures of temperament than in the raw ability scores as measures of intelligence. To illustrate, in the normal person we can expect that a vocabulary test will give results very similar to the results obtained from a perceptual intelligence test (we assume, of course, that there are no special defects of education present among the testees). However, when we turn to neurotic groups, we find that among hysterics there is a marked tendency for the perceptual intelligence test to give higher scores than the vocabulary test. On the other

hand, for patients with anxiety states and for depressives the opposite is true; these groups tend to have higher scores for vocabulary tests than for perceptual intelligence tests (Himmelweit, 1945). Similarly, Wechsler (1941), Rapaport, Gill & Schafer (1945) and others have shown that the pattern of scores on the ten sub-tests of the Wechsler Tests of Adult Intelligence tends to form, among psychotics, different patterns for the various psychoses, for patients with brain injuries, as well as for neurotics and normals.

Other differential ability scores of particular interest are those of the Porteus Maze Test when compared with the general intellectual level of the person. It has been shown in several studies that this test measures, in addition to intelligence, a certain quality of foresight, as it is rather obscurely called, which seems to aid its possessor in normal social adjustment. It is a quality which seems to be more closely connected with the frontal lobe than is sheer mental ability, because it has been shown that after prefrontal leucotomy loss of ability on the Porteus Maze Test is much more marked than on any other test of ability. There are other sources of evidence which indicate that the Porteus Maze Test may justly be regarded as a measure of certain non-intellectual, temperamental factors. (See Porteus & Peters, 1947a, 1947b.)

The introduction of objective tests into the measurement of personality is relatively recent and is probably the most promising line of investigation at the moment. Much remains to be discovered, particularly about the interrelations of different tests, but we know enough already to be able to say that a relatively consistent scheme of personality structure can be based on the results of objective personality tests (Eysenck, 1947a).

### 3. Projective Techniques

Projective techniques are based on the theory that an individual betrays his personality in everything he does or says by projecting the contents of his mind on to the material with which he is presented. If, for instance, as in the Rorschach Test (1937), he is presented with a series of unstructured ink-blot which he is asked to interpret, this interpretation will be determined largely by the matrix of his personality. The inverse is also possible; that is to say, by studying his responses to these ink-blot we should be able to argue back to the type of personality which has produced them.

Similarly, in the Thematic Apperception Test (Murray, 1938) the subject is given a number of pictures representing certain rather vaguely constructed situations and is asked to tell a story about these pictures, what is happening, what has led up to the situation depicted, how it will all end, and so forth. The interpretation given to the figures in the picture, the fate which they have endured or towards which they are going, the emotions and feelings which they are made to express, and their attitudes towards each other, are held to be projections of the subject's own feelings, attitudes, emotions, and so on, and are interpreted accordingly.

In the Sentence Completion Test (Rohde, 1947) the beginning of a sentence is presented to the subject, as for instance: "What annoys me most.....", or "I think sex.....", and he has to finish the sentence in some

way himself. The way in which he finishes it is interpreted again in terms of the projective technique.

The Szondi test (1947) has recently become popular on the continent of Europe and in America. It is based on the theory that persons of a certain type will have certain emotional reactions to photographs of people of a similar type, either by way of liking or disliking them intensely. The test, therefore, consists of six series of eight pictures, each picture being chosen to represent one of the eight fundamental types which Szondi recognizes. The eight pictures of each series are spread out before the subject and he is asked to select the two he likes best and the two he likes least. A record is made of his choice and the same procedure is repeated for the remaining five series. From the pattern of his choice a detailed personality diagnosis is made. This test is introduced by its author in conjunction with a rather pretentious, semi-metaphysical and pseudo-genetic scheme of personality theory which is demonstrably false. However, this does not necessarily prove that the test itself is valueless and there is much subjective testimony in its favour.

While some projective techniques, such as the Szondi Test and the Thematic Apperception Test, are relatively novel, others are relatively old, as far as psychological testing techniques go. Among these are Freudian dream-interpretation, the study of paintings and artistic productions generally, and play techniques, in which the child's or adult's methods of play are interpreted in accordance with the projective hypothesis.

Probably, the earliest projective technique was the word association test, first used by Galton, in which the experimenter says a word to the subject, who has to respond with the first words that come to his mind, the theory being that his response will reveal certain associative links of which he himself may be unaware. This technique has been elaborated a good deal by combining it with others, such as, for instance, a recording of changes in the electric resistance of the skin (the psychogalvanic reflex or electrodermal response), motor movements on the part of the subject (the Luria reaction), and so forth. The Luria technique, which consists essentially in the study of the disruption of motor responses caused by emotional experiences, leads, naturally, to another type of projective test, namely, that concerned with the study of expressive movements (cf. Luria, 1932). Here, we have a large body of speculation and experimental validation which has arisen out of the study of handwriting (graphology), and also of the more strictly controlled measures of a person's ways of moving his hands, feet, or whole body (Allport & Vernon, 1933), which can be interpreted as expressive of his personality.

On the whole, it cannot be said that these techniques have fulfilled their early promise. Interpretation is still very largely subjective, intuitive, and unscientific. Evidence concerning the reliability of these methods is disappointing and evidence concerning their validity is almost wholly lacking or of such a kind as not to be particularly convincing. Nevertheless, attempts have been made recently to make the scoring of these tests more objective and to elude proper evidence in their favour; should these attempts prove successful, there is little doubt that projective techniques would assume a very important position indeed in the armamentarium of the psychologist.

#### 4. Observational and Sociometric Methods

Among the earliest methods of personality assessment were those of simple observation and rating, a group of methods which, presumably, should include the interview also. Much work has been done in recent years to refine and objectify these methods, as may be seen, for instance, from the account given by Vernon (1938), Symonds (1931), Greene (1941), and others. Outstanding examples of careful observational records are Bühler's (Bühler *et al.* 1939) twenty-four-hour records of family situations, collected by trained workers who went into private homes, and Newcomb's (1929) analysis of detailed daily records made by counsellors in a summer camp in order to assess extraversion and introversion.

A particular variety of the general method of observation is that of time sampling. The subjects under investigation are observed for a specified number of minutes, a certain number of times every day. A record is made of the frequency with which they indulge in certain types of activity such as laughing, crying, quarrelling, etc., and this record forms the basis of the study. Such reports can be made very objective and are usually extremely reliable (Olson & Cunningham, 1934). They are particularly useful in a social situation where the experimenter has little control over the variables in which he is interested.

As an additional aid in the analysis of personality traits in social situations, the investigator nowadays often makes use of sociometric techniques (Moreno, 1934). These consist essentially in asking each member of a group with which other member of the group he would most like to participate in certain activities, which member he would like to sit beside him at meals, etc. From these records of attractions and repulsions between members of the group a pattern is derived which has been found to be very useful in many ways.

This method is particularly relevant to the part of the definition of personality quoted at the beginning which stresses the way that a person's "cognitive, affective, conative, and physical characteristics manifest themselves in focal distinctness to others." The sociometric technique shows us through the eyes of "others" just how the individual's personality manifests itself and techniques of this sort are therefore indispensable adjuncts in a thorough study of personality. During the recent war, modifications of these ratings and sociometric techniques have been found of some use in officer selection procedures.

#### 5. Summary

We have been able to give only a small number of examples to illustrate the main types of personality tests used nowadays. The interested reader will find a complete review of the hundreds of tests in common use in the *Mental measurements yearbook* (Buros, 1949), in the bibliography by Hildreth (1945) and in other similar compendia. The setting in which these tests ought to be evaluated is probably best given by Stagner (1947) and at greater length by Gardner Murphy (1947) or by Allport (1938). Greater details about the methods of measurement, and evidence regarding the reliability and validity of tests, as well as their use in various connexions, may be found in books by Hunt (1944), Greene (1941), Cattell (1946) and Eysenck (1947a).

While the assessment of personality, judged from the

points of view of validity and reliability, is still very far from the certainty which inheres in measurement as understood by the physical sciences, there can be little doubt that the methods reviewed here have led us a long way

from the subjectivity of pure intuitive understanding and have enabled us to come to grips, on a purely objective basis, with this very protean and elusive thing—the human personality.

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## RECENT DEVELOPMENTS IN THE MEASUREMENT OF INTELLIGENCE AND SPECIAL ABILITIES\*

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- 1 General intelligence tests
    - a Tests for children
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  - 2 Diagnostic testing and factor analysis
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### 1. General Intelligence Tests

#### a. Tests for Children

The revision by Terman & Merrill of the Stanford-Binet scale was published in 1937, and has by now become the standard test for measuring the intelligence of individual children in schools and clinics. It is a reliable and objective instrument when properly applied by trained testers, and it covers the whole range of mental ages from 2 to about 23 years (superior adult level). But it shows certain defects, particularly at upper ages. Evidence is accumulating that the order of difficulty of the component sub-tests, and the standardization, are inaccurate in Britain. Mental ages above about 12 years seem to be seriously exaggerated, so that high intelligence quotients (I.Q.'s) are much too high. The heterogeneous content of the scale is also open to criticism. True, this helps to maintain the child's interest, and allows the tester to observe the child's mind working in a great many different ways; but it also tempts the tester to jump to unwarranted conclusions about special abilities and disabilities. The verbal, practical, spatial, numerical, reasoning, and other types of sub-tests do not provide adequate measures of distinctive 'types' of ability. At the same time the scale does not measure one and the same ability throughout. Investigations using the technique of factor analysis, by Burt (1939) and others, show that it is primarily a measure of *g*—the general intellectual factor—but that it is biased or distorted in various directions at various age levels. The verbal-educational or *v* factor does enter to a considerable extent, particularly at higher mental ages (hence educationally retarded children tend to be handicapped), and numerical, spatial, and other abilities exert minor influences.

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#### b. Tests for Adults

For these and other reasons a different individual test is generally preferred for testing adolescents and adults, namely the Wechsler-Bellevue scale (Wechsler, 1939). The full scale consists of six verbal and five non-verbal (performance) sub-tests. Each sub-test contains numerous graded items and yields a separate score. From the total scores a verbal and non-verbal I.Q. are obtained, and separate norms are provided for different age groups. Unlike the Terman-Merrill scale, therefore, the Wechsler scale is homogeneous; it measures the same combination of abilities at all levels. It is somewhat lengthy to apply, and several abbreviated versions have been adopted. In the Royal Navy and the Army during the war, for example, individual testing was frequently carried out with the comprehension, similarities and vocabulary sub-tests from the Wechsler, and with the Trist-Misselbrook revision of Kohs Block Design as a performance test.

#### c. Group Tests

Experience in the Services suggests that, except perhaps among defectives and psychiatric cases, the intelligence of adolescents and adults can be measured as effectively by a battery of suitable group tests as by any individual scale. Such a battery usually includes a non-verbal test such as the Raven Progressive Matrices, one or two verbal and arithmetical tests, a mechanical test and a spatial judgement test. Follow-up research has proved that this gives useful predictions of capacity for almost any Service job. The particular tests found most valuable in naval, military and air-force personnel selection have been described by Vernon & Parry (1949). The results of these tests are usually expressed, not as I.Q.'s, but as Selection Groups or Grades. SG 1 (or A) represents the top 10 % of scores, SG 2 (or B) the next 20 %, SG 3 (or C) the middle 40 %, SG 4 (or D) the next 20 %, and SG 5 (or E) the bottom 10 %.

Few group tests of note for children have been published in Britain during the past 10 years or so. Nevertheless the practice of including an intelligence test, such as one of the Moray House series, in examinations for secondary school allocation at 11 or 12 years has become more and more widespread. When tests are thus employed competitively, serious problems of coaching and of the effects of practice arise. Previous practice on similar tests will raise intelligence quotients by an average of 2 to 10 points, depending on the particular type of test. Research suggests, however, that the law of 'diminishing returns' operates, hence coached children have relatively little advantage over uncoached if all are given some practice at the time of the crucial test.

For testing children of 3 to 5 years, the Terman-Merrill and the Merrill-Palmer scales still seem to hold the field in Britain. It is generally admitted that no tests for even younger children (such as the Gesell schedules) provide reliable indications of later intelligence. There has been little change also, during the past decade, in performance tests of intelligence, except in their price; the cost of the better known scales (Pintner-Paterson, Arthur, Collins-Drever, Alexander) and of the common picture and form-board tests has become almost prohibitive. That testers should be forced to pirate tests or to use non-standard materials is a most unsatisfactory state of affairs. Actually



it is highly probable that just the same ability or abilities could be measured by printed pictures and diagrams as by practical tests, but manipulative materials naturally arouse more interest among young children and dull adults and so produce easier rapport. Most picture and formboard tests are rather poor measures of the *g* factor, while constructional tests and paper and pencil tests involving imaginative manipulation of shapes bring in, in addition, the spatial judgement or *k* factor.

## 2. Diagnostic Testing and Factor Analysis

Mental testing has become much more detailed or analytic during the past decade. Important developments have occurred along two main lines which, though largely independent so far, should eventually complement one another. In the nineteen-twenties and early thirties testers were for the most part content to measure general intelligence by means of batteries of miscellaneous items or sub-tests, together with a few more specialized abilities such as mechanical, arithmetical, musical, etc. Psychologists in clinics often guessed that particular types of items were diagnostic of particular mental functions but they seldom possessed any empirical evidence for these "hunches". The two methods by which such evidence is now being accumulated may be termed the clinical and the factorial.

### *a. Clinical Methods*

The clinical approach involves establishing differential test performances among different clinical groups. Using the Wechsler-Bellevue scale, for example, Rapaport, Gill & Schafer (1945, 1946) and others have described different patterns or profiles of scores on the various sub-tests among schizophrenic, paranoid, depressive, hysteric and other psychotic and neurotic patients. The greatest amount of work has been done on tests of mental deterioration. It is widely agreed that intellectual ability can be divided into what Cattell (1943) calls "crystallized ability" or the reactivation of past experiences and knowledge, on the one hand, and "fluid ability" or the present efficiency of mental functioning, on the other hand. The former is usually measured by vocabulary tests, or sometimes by information and arithmetic tests, which are relatively little affected by pathological conditions, the latter by tests involving abstraction or seeing new relationships or by tests of quickness of response. The Wechsler sub-tests provide contrasting scores of these two types. Probably less reliable, but widely employed, is the Shipley-Hartford deterioration scale, based on two short group tests of vocabulary and abstraction. Babcock's mental efficiency test (Babcock & Levy, 1940) uses, in contrast, three tests of learning (e.g. recall of stories), three motor tests (speed of writing, etc.), and three of repetition (digits forward and backward). Brody (1944) provides a useful review of these and other tests, and points out the difficulties of distinguishing actual deterioration from the effects of age and of the lack of co-operation so common in mental patients.

Innumerable other tests have been devised to measure conceptualization and generalization, perceptual and learning capacities, and other mental functions which are supposedly affected in cases of cerebral injury, aphasia and psychosis. Similar tests are used for exploring the effects of shock therapies, drugs, leucotomy and lobotomy; they include

the Hanfmann-Kasanin concept-formation test, Weigl's and Vigotsky's sorting tests, Bender's visual gestalt test, Rorschach inkblots and other projection tests. Descriptions may be found in Rapaport *et al.* (1945, 1946) and Klebanoff (1945). Many of these are still in the qualitative stage, and few quantitative differences between different types of mental patient have yet been firmly established. Without denying the fruitfulness of investigations with such tests, we should also realize that most of them do not measure adequately defined and distinctive abilities. For example, a study was made of 15 alleged tests of 'memory', which showed that the underlying ability measured by them was nothing more than *g* (Eysenck & Halstead, 1945). It is desirable therefore that diagnostic testing should be carried out only by persons who possess both clinical experience and a good grounding in psychometrics, which will help them to avoid the fallacies of faculty psychology and of over-reliance on intuition. The days are past when psychologists in mental hospitals were merely asked to "I.Q." a patient, but their diagnostic tools have certainly not reached the same scientific precision as those of, say, the biochemist.

### *b. Factorial Methods*

The alternative approach of factor analysis attempts to map out the distinguishable factors or types of ability by studying the extent of overlapping (correlation) between large numbers of tests. The dependence of each test on such factors can then be determined (its 'factor saturations') and we can choose one or more tests to measure precisely the abilities in which we are interested. Spearman's views (1927) on the all-pervasiveness of the general ability or *g* factor are largely confirmed by recent research, but numerous additional types or sub-types have been isolated. We have already mentioned the verbal, numerical, spatial and mechanical. Thurstone & Thurstone (1941) have described seven primary factors which are remarkably similar at all age levels from 6 years to adulthood, namely word fluency, number, space, rote memory, perceptual speed, and inductive and deductive reasoning. There is still however considerable disagreement as to the number and scope of the factors required to give a complete map of human abilities. It is reasonable to suppose that children and adults suited to different types of education and to different jobs will have different profiles of scores on such factors, though research in this direction is only just beginning. Several batteries of 'differential aptitude tests', designed to yield profiles, have been published in the USA by the Thurstones (1941), the United States Employment Service (Dvorak, 1947), and others. But their construction and standardization are so complex, time-consuming and expensive that nothing comparable is yet available in Britain. It is noteworthy that many American group-tests are issued with special answer sheets which can be automatically scored by an electrical counting machine.

## 3. Vocational and Educational Tests

In the field of vocational selection and guidance, there is less emphasis nowadays than formerly on analytic or analogous tests—that is, tests aimed at the specific aptitudes supposed to underlie each job; the tendency is rather to measure the more general abilities which enter into a wide

variety of jobs. In the British Forces during the war this policy was dictated largely by shortages of materials and of persons experienced in job analysis and test construction. But several investigations of tests for gunners, motor drivers and other categories indicated that specialized tests add so little to predictions based on general tests plus background information (obtained by questionnaires and interviews), that it would be uneconomic to introduce them (cf. Vernon & Parry, 1949). Similarly Guilford (1948), from experience in the United States Army Air Force, points out that tests designed to measure the abilities considered to be involved in a particular job often correlate more highly with success in other jobs, and he prefers tests whose factorial content is known to those based on subjective analyses of job requirements.

Two types of vocational tests were, however, found specially useful as supplements to a general battery, firstly, tests of information and secondly, 'work-sample' and 'miniature situation' tests. In the Services a simple test of everyday mechanical and electrical knowledge gave better indications of trainability in mechanical and electrical jobs than did practical tests involving the assembly of mechanisms. Similarly, tests of trade knowledge yielded reliable assessments of relevant experience among tradesmen. Work-sample testing involves trying out the candidates for a short time on the job itself. Thus the wastage of pilots in the RAF was spectacularly reduced by eliminating trainees who made least progress in the first 5½ to 11½ hours of flying instruction. Some evidence was obtained that the same approach would be the most hopeful one for selecting gunnery ratings in the Navy. Often, however, the trials can be carried out, as it were, in miniature. Aptitude for learning the Morse code among potential signallers and telegraphists was measured by training recruits for some 20 minutes on three actual Morse characters, and then testing the speed and accuracy with which they could receive a long series of these three characters. Under this heading also fall the important developments of recent years in methods of selecting officers, business managers and high-grade civil servants, in which observations are made of the personal and social reactions of small groups of candidates engaged on exercises psychologically similar to their future jobs. These methods cannot, however, strictly be called tests, since they do not involve objective measurements of the candidates' behaviour. Depending as they do on subjective assessments, their value varies tremendously with

the acumen and experience of the observer or testing officer.

Tests of educational attainments are particularly important in examining children at Child Guidance Clinics, and in educational selection. For the former purpose Burt's series of (mainly individual) tests is still invaluable, though standards have tended to rise since they were published in 1921, and then to drop markedly since 1939. Much as in the field of intelligence, testing in this field also is becoming more analytic. For example, Schonell's (1942) diagnostic reading and arithmetic tests assist the clinic psychologist to plan the most appropriate remedial coaching for each backward child. An outstanding investigation of the relative value of intelligence and educational tests, school examinations and teachers' opinions, for selection at 11-12 years, has been published by McClelland (1942). There is at present considerable interest in, but also disagreement as to, the possibilities of differentiating the technical from the academic or other types of pupil at so early an age, by such tests as Earle's Duplex series and Alexander's performance scale. That tests can play a useful part in the selection of university students is shown by Eysenck's (1947) review. Promising attempts have also been made in America to test aptitude for professional training—medical, legal, engineering, etc., and experiments with tests for medical students are under way in Great Britain.

#### 4. Conclusions

The main themes of our survey are the great expansion in the scope of mental testing in recent years, and the search for scientific evidence as to what our tests actually measure. We should not conclude, however, without some words of caution. The development of larger numbers of more accurate tests enhances the need for psychologists experienced in construction, application, and interpretation of results. Adequately trained testers are in very short supply, and there are grave dangers in the over-popularization of testing among amateurs.

Finally the role of tests should not be exaggerated. War-time research has indeed proved the superiority of scientific methods of assessing abilities over older methods, such as the uncontrolled interview and the essay examination, which depend too much on the vagaries of human judgement, but it has also shown how far tests are at present from covering all the factors that make for educational or vocational success or failure.

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## THE CONTRIBUTION OF ANALYTICAL PSYCHOLOGY TO PSYCHOTHERAPY

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- 1 Main concepts of analytical psychology
    - a The theory of psychological types—the psychology of the conscious mind
    - b The unconscious
  - 2 The pattern of analysis
  - 3 Frequency of interviews
  - 4 Dream analysis and active imagination
  - 5 Conclusion
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In this paper I shall attempt to outline the main features in the science of analytical psychology which may be of interest or use to the psychotherapist in the practice of his art. In so doing I shall refrain from describing psychotherapy in detail and this for several reasons: firstly, it would not be possible within the scope of this article; and secondly, even if it were, there are too many psychotherapeutic methods and processes to make a comprehensive description possible at the present juncture. Neither of these reasons, however, touches the central core of the problem, which lies in the fact that psychotherapy, in a deeper sense, is individual in its nature. (Group psychotherapy is not included in these notes.) Because of this, attempts to classify psychotherapeutic methods can have only relative value and will never eliminate the fact that the process is a dialectic developing between two unique persons who, because of their individuality, are not subject to classification.

In this article the individual element in psychotherapy will be taken as an essential part of the process. Attempts to eliminate it are merely retrograde, since they bring us to a state characteristic not of civilized but of primitive peoples who, owing to their undeveloped consciousness, regard individuality as a dangerous phenomenon; indeed it requires such an effort of mind on their part to discriminate between one person and another that they find it almost beyond their capacity (Jung, 1934). Since any psychotherapy worthy of the title has become identified with the development of conscious discrimination, we cannot regard uniformity of method as an aim, for this necessarily implies that patients are uniform and have no individuality. To apply a method is, however, the correct procedure in cases where the problem is one of adaptation in the social sense, that is,

where the patient is too individualistic and remote from the instinctual basis of his life. However, the method will fail if it violates real individual values.

Methods are tools in the hands of the doctor, and the way he, as a human being, uses them is the significant factor in psychotherapy; in short, his personality can never be overlooked but is rather a central factor in the therapy. Because of this consideration, analytical psychology has always placed a personal analysis in the centre of its requirements for the training of its analysts. This analysis aims not only at raising consciousness to a level which can reasonably be expected of the candidate, but also goes far to ensure that his desire to become an analyst is founded upon a secure basis. This occupational test is necessary because there are too many who aspire to cure others because of their own inability to cure themselves. In such cases, if the training analysis of the candidate is successful, the desire to become an analyst will simply disappear.

But once the analysis is completed the analyst cannot sit back and assume that he is now without blemish. Therefore the analytical psychologist sits facing, or beside, his patient; the couch is seldom used though some analysts consider it valuable for patients who cannot relax in a chair. Sitting in view of the patient ensures that observations can be made by eye as well as by ear. The position of sitting in full view also expresses the analyst's willingness to treat the subject as an equal on a fundamental plane, even though the analysand may not believe this to be so because of the transference. Lastly, the position shows the analyst's willingness to reveal himself. This last requirement is the one above all which makes it essential for the analyst to be aware of himself, and sufficiently integrated to be capable of knowing and tolerating his own unintegrated condition. On the face of it, unintegrated responses look undesirable, but inferior reactions are not to be avoided and, so long as they are recognized as such, can be of positive as well as of negative value. On the other hand, concealed inferiorities fascinate and hinder the analytical development just because they cannot be seen but only vaguely felt as unexplained consequences of the hidden complex within the analyst.

### 1. Main Concepts of Analytical Psychology

Before going on to consider further aspects of the analytical procedure, it will be necessary to consider briefly the fundamental ideas upon which the practice is based. The best known work of Jung (1933), upon which analytical psychology bases its practice and research, consists of two interlocking structures—on the one hand, the theory of types concerned with different kinds of consciousness; on the other, the theory of the unconscious which Jung divided into two parts—a more superficial, personal layer and a deeper, collective or impersonal layer.

#### a. *The Theory of Psychological Types—the Psychology of the Conscious Mind*

This theory is an elaborate structure, by no means easy to understand and apply, but it provides the psychotherapist with a means of determining the attitude of the conscious mind. It is therefore a stepping-stone towards differentiation, somewhat like psychiatric classifications, but aiming to assess, via the attitude of the conscious mind, the personality as a whole rather than its pathological part.

According to the theory, there are four possible attitudes of consciousness: two rational, *thinking* and *feeling* (valuation), and two irrational, *sensation* and *intuition*. To this already complicated structure is added the notion that the conscious attitude may be directed outwards, *extraverted*, or inwards, *introverted*.

Once the attitude of the conscious mind has been determined, we are in a position to infer the attitude of the unconscious, because of its opposite attitude to that of the conscious mind. The unconscious attitude complements that of consciousness and contains the neglected, undeveloped and incompatible functions.

A moment's reflection will show that the number of "types" which this system will contain is large. Partly for this reason and partly because we know that considerable modification in type is possible, it could never be used in a rigid fashion. The eight types which Jung describes in his classical work make up an axial system through which one may orientate oneself amongst the variety of human beings whom the psychotherapist is bound to meet in his practice. Here we may note that the whole system is bound up with the process of individuation and the fourfold structure of the psyche of which the type theory is an expression.

#### *b. The Unconscious*

Jung divided the unconscious into two layers which he called the acquired, repressed or personal unconscious; and the innate, collective or impersonal unconscious—the fundamental matrix out of which consciousness grows.

The theory of the collective unconscious is based upon the notion that the fundamental structure of the psyche is uniform and that in the last resort, if we could eliminate consciousness, there would be little or no difference between one human being and another. There is therefore an "X", psychic but unconscious in its nature, out of which consciousness grows. This "X" is the precursor of fantasy. When it appears in fantasy form, it is in the first place the symbolical expression of instinct; but it always adds something else which is not, and never has been, exactly defined, and which is, and always has been, referred to in such terms as "spirit", "pneuma" or "numinosum"—terms which defy intellectual appraisal. Jung's idea is then that the unconscious is a fundamental reality and he uses St. Augustine's term "archetype" to denote its functional parts. The essential nature of the archetype is indefinable, in very much the same way as the mathematical symbol  $\pi$  is indefinable, that is, however far you go there is no possibility of determining exactly what it is. For this reason, the archetypes are understood as fundamentally unconscious functions.

It is evident that a fantasy is a more or less conscious product and its content is often, but not always, referable to various already known images. In consequence, the archetype usually shows itself by its selective capacity and is consequently more or less obscured. We can, however, remove these darkening components by the method of amplification, in which parallel myths are brought forward to amplify or show up the essential core within the conscious form. This method of amplification is therefore held by analytical psychologists to be an essential acquisition of the analyst. It necessitates a considerable knowledge of mythology and comparative religion, which must be accumulated, not with the object of burdening the analyst unnecessarily with intellectual knowledge, but so as to

provide him with the necessary means to orientate himself and, if necessary, his patient as well. This means that any analyst's training involves the acquisition of considerable knowledge concerning the growth of civilization in its many aspects.

#### 2. The Pattern of Analysis

The pattern of analysis can be laid down as a process consisting of three stages.

The first consists in confession of material already conscious, proceeding to clarification of subliminal material which has been half- or pre-conscious.

When this material has been discussed and interpreted we can proceed to the second stage, the analysis of the personal unconscious. This consists in unearthing memories and past experiences which have not been resolved, and in the clarification of personal feelings which, through the action of repression, have not been allowed to come into consciousness.

As this process goes on we begin to see the archetypes of the collective unconscious emerging, at first hidden behind the personal experience and then coming more and more into the open; this indicates the onset of the third stage. The classical analysis develops now as an internal dialectic which releases the patient more and more from the analyst owing to the operation of the individuation process. It is this process, first described by Jung (1928), which culminates in the emergence of the *self* after a more or less typical development in which the archetypal figures come increasingly to the fore in various shapes, called "The Shadow", the "Animus" and "Anima", the "Old Wise Man" and the "Old Wise Woman".

We can view this typical analytical process as part of the whole development of an individual life, which gradually unfolds itself as the years go on. We can indeed link it up with the phases of life, for the age of the patient is of essential significance as a guide to the conduct of psychotherapy. Jung described the individuation process as a phenomenon of the second half of life, i.e. starting between 35 and 40 years of age. At this stage the ego is firmly established and the individual is able to give libido to the more fundamental problems of the living process in a more impersonal form. During the first half of life, on the contrary, the problem centres first of all round the development of the ego in connexion with personal relationships, as a preparation for more independent living. For this purpose the parents are necessary containers of the child's existence. When the child becomes a man or woman, the problem changes, and becomes then how to achieve sufficient independence of the parents, to work, earn a living, marry and found a family. When this is done, what next? A peak has been reached, after which a gradual descent to old age and death begins—it is a period of increasing introversion. At this peak, a change occurs which heralds the increasing need for revision and reflection upon the fundamental problems of life as experienced by the individual; in other words, the problem of individuation comes to the fore. If we consider the therapeutic problems in the light of these observations we arrive at the conclusion that different periods in life demand different kinds of attitude. In the first half, the problems are of a personal nature, and in consequence the therapeutic process will centre round

the personal unconscious ; in the second half, the collective unconscious will contain the essential problem of individuation. Our scheme will therefore serve as a guide to be taken in conjunction with the stage in life through which the individual is passing.

### 3. Frequency of Interviews

Analysts vary in their opinions regarding the frequency of interviews ; moreover, the stage reached in the analysis has to be taken into consideration. Jung (1935) regards four times a week as sufficient. In the early stages of analysis frequent interviews are desirable, particularly during the period when the contents of consciousness are being confessed and when the personal unconscious is being analyzed. During this period the transference is developing and is being handled on the objective plane. By this is meant, objective situations in the past are being revealed through the transference which has to be analyzed in detail in relation to the past.

When, however, the analysis reaches the level of the collective unconscious a different situation begins to arise. The contents of the analytical transference become less and less personal and, provided the ego is sufficiently established, the subject is able to take responsibility for the material arising out of the unconscious, which he sees more as an inner problem of his own. This process can be fostered by interpretations which bring the patient into relation with himself—interpretations on the so-called subjective plane. These interpretations herald the synthetic part of the analysis.

With these considerations in mind, it follows that the number of interviews may be reduced at this juncture. It is part of the natural development towards taking responsibility, i.e. psychosynthesis.

As a consequence of these reflections, and taking them into consideration with the section on the pattern of analysis, we can see that interviews will be more frequent for subjects under 35-40 years of age than for those who are older. This is so because in the first half of life the problems are predominantly personal, whilst in the second, they become collective and impersonal.

### 4. Dream Analysis and Active Imagination

Analytical psychology distinguishes two ways of approaching dreams. The first consists in employing free association to the dream material. By this means is produced a long string of seemingly disconnected material which leads to the complexes. The other method consists in determining the dream context. This is done by amplification ; according to this method we need only association material in order to show the context. Two kinds of contexts are required—the personal context, in which case the patient's associations will provide what is necessary, and the collective context, in which case mythological material may be supplied by the analyst in order to throw into relief the collective matrix out of which the dream symbol arises.

Though the use of free association has become familiar, amplification has not, and it will therefore not be out of place to say something further about its nature. Amplification is an extension of a natural process which has been observed in dream series. In these series, the symbolism develops in a particular way, and refers to a central problem

or symbol by means of analogies, revolving round it and gradually concentrating more and more upon its central nature. Thus the material referring to the central symbol amplifies the central content or throws now one, now another, of its aspects into relief until an almost complete picture is built up. By bringing parallel myths to bear upon a symbolical product we intend the same thing, and are therefore employing the "method" of the unconscious, but concentrating into a short space what may take months or years to develop.

These methods are preliminary ; they precede the interpretation, which cannot be made without collecting the necessary material. When this material has been collected the question arises of whether it needs to be understood upon the objective or the subjective plane. The objective plane refers to external objects, i.e. actual people in the environment ; the subjective, to internal "persons" or archetypes. Which interpretation is relevant depends upon the attitude of the conscious mind, whether it be extraverted or introverted, and the stage of analysis which has been reached.

Without going further into the complications of this problem, we shall follow up the consequences of subjective interpretations which lead inwards to the collective unconscious. When the interpretations bring the archetypes into clear relief, the process of active imagination can be set in motion. In this process the conscious mind is brought into relation with the archetypes which, out of their own activity, produce fantasy images ; an inner drama starts, in which the conscious mind participates in a more or less active way. This process is analogous to artistic creation or religious inspiration, showing analogies with such processes as meditation and contemplation.

The process, when in action, needs to be undertaken under analytical supervision within the transference, at least in the first place, though as the development proceeds and becomes more and more real the transference, now consisting of collective archetypal contents, gradually gets undermined until the individuality eventually emerges as a central core round which the personality revolves as a coherent whole.

Active imagination does not do this ; it is simply a valuable adjunct to a development which can as well occur in dreams. This development is augmented and hastened forward, however, by allowing the material to emerge in the day-time as well as at night.

### 5. Conclusion

This brief review of the contribution of analytical psychology to psychotherapy can do no more than hint at the processes which have been described. The scientific work undertaken has complicated the psychotherapeutic field, but this complexity was certainly there in the first place. In approaching the psyche and describing its phenomena, analytical psychology claims to have placed the psychotherapist in a position to deal more effectively with the obscure realms with which all those engaged in that art have to contend.

The question will necessarily be raised : in what kind of cases will Jung's methods be most useful ? From what has been said, it will be clear that Jung's work frees us from the necessity of pursuing one method alone, but rather provides

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## THE POSITION OF PSYCHOANALYSIS IN GREAT BRITAIN\*

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- 1 Development of psychoanalysis in Britain
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  - 4 Present situation
- References

The reader who turns expectantly to reviews of "recent work" on psychology hoping to find therein evidence of outstanding "progress" during the past ten years is doomed to some disappointment. In the case of the physical sciences, once the fundamental principles governing any particular branch have been laid down, one may expect to find that year by year extensive advances have been made in a number of directions. It is quite otherwise with psychological science. The more dynamic it is and the more it is concerned with the unconscious functions of mind, the more it works against a head of resistance and consequently the slower the pace of discovery. Even the impact of war, which, again in the case of physical sciences, usually accelerates the rate of discovery, produces little or no positive effect in the psychological field—rather the contrary. The tendency of psychology during war and for some time afterwards is reactionary. The energies of psychotherapists are diverted to the application of short-cut forms of treatment, usually old methods dressed up as new. Hence no discoveries of consequence are made.

With this preamble, it can be stated that since the death of Freud in 1939 no advances of importance have been made in the field of psychoanalysis in Great Britain.

\* [See also article by W. Clifford M. Scott in this number (BMB 1293).—Ed.]

Nevertheless certain significant changes in the tendency and direction of the psychoanalytic movement have taken place. And these are worth recording.

### 1. Development of Psychoanalysis in Britain

Before doing so it is desirable to outline briefly the development of the psychoanalytic movement in this country. It commenced only a few years before the outbreak of the First World War. At that time Freud's theory of the unconscious, of dreams, and of the neuroses was well established; and a small group of pioneers centred in London, having founded the London Psycho-Analytical Society, devoted themselves to practising and teaching Freudian principles. After the close of the war this society was reconstituted as the British Psycho-Analytical Society. In the meantime Freud had developed and expanded his theories in a number of directions and was about to enter the second great phase of his theoretical formulations. Up to that time the concept of unconscious mental conflict, and with it the theory of neurosis, had presumed an antithesis of libidinal (in the general sense, sexual) instincts and the ego-instincts, in particular the impulses of self-preservation, together with certain reactive (aggressive) impulses. The neuroses were regarded as compromise formations representing both the repressed and the repressing forces, which latter were held to operate through the unconscious ego and to be activated by the ego-instincts.

The new orientation in Freud's theory was due to a number of factors. Most important of these were the extension of his researches into the structure of the unconscious ego, and fresh understanding of the part played by the impulses of aggression in ego development. The groundwork had already been prepared by his investigation of melancholia, from which Freud was able to postulate the existence of early differentiations of the unconscious ego. The modern psychoanalytical concept of the super-ego, or unconscious conscience, was developed from these studies. The function of the super-ego, which is derived essentially from an internalization of parental influences, is to exercise, or more accurately to instigate the unconscious ego to exercise, control over primitive impulses threatening danger to its stability. At the same time Freud was able to demonstrate that the forces giving rise to disorder of super-ego function, of which melancholia is the exquisite example, were not only the narcissistic components of the libido with which the ego is invested, but the aggressive

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us with a number of pointers which will guide the psychotherapist in his relationship to his patient. Therefore this work is applicable to a wide variety of patients, but the special contribution of Jung's work is to introverted psychology and to those in the second half of life. We may say, therefore, that the introvert will naturally be more attracted than the extravert, whilst older and more mature personalities, who need to evaluate their lives in terms of original experiment and through this to find an

individual rather than a collective solution, are likely to find in analytical psychology a means of arriving at an answer to their problems.

Finally, we should not end without referring to the special contribution which analytical psychology has made to psychiatry. It has proved especially useful in cases of schizoid personality and thus provides a means of approach to schizophrenia itself.

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impulses which are loosened when any pathological disturbance takes place in the relation of the ego to its instinctual objects. These aggressive impulses, when let loose within the unconscious ego, give rise to a variety of pathological changes varying in accordance with its stability from mild neuroses to the most extensive psychoses.

Obviously a new orientation in the Freudian theory was necessary: and Freud did not hesitate to make the necessary changes. Abandoning his concept of special (non-libidinal) ego-instincts, he postulated the existence of an unorganized psychic institution, the id, which is also a reservoir of all instinctual forces. He also distinguished at the periphery of this system ego-institutions, i.e., the super-ego, concerned with the supervision of libido and aggressive instincts, and the ego proper, concerned with the maintenance of adequate systems of discharge in reality. The self-preservative impulses were then regarded as libidinal in nature—an extension therefore of the earlier and more limited concept of narcissistic libido; and the instinctual antithesis between libido and ego-instincts was replaced by a deeper antithesis between the “erotic” or “life instincts” and the aggressive instincts which Freud held to be a derivative of a fundamental “death-instinct” or “innate tendency” of living matter to return to the inanimate state. These views he set forth in three monographs (Freud, 1922a, 1922b, 1927).

The impact of these new ideas on the British Psycho-Analytical Society may be said to have taken effect roughly about 1926. Up to that time the Society was, on the whole, a conventional group undisturbed by schisms and controversies and, perhaps for that very reason, rather uninspired. The bulk of psychoanalytical research and discovery was the work of three groups, in Vienna, in Berlin and in Budapest, although it is undeniable that up to a few years before his death Freud himself was responsible for the lion's share of this work. In England, apart from the papers of Ernest Jones (cf. Jones, 1948), little of significance was published. Naturally, therefore, the new ideas were at first taken over without reservation, although a few members found difficulty in accepting Freud's concept of the “death-instinct”. As, however, the fundamental discoveries regarding conflict, repression, symptom- and dream-formation and the nature of transference were not disturbed by this theoretical concept, there was at first no sign of scientific differences within the British group.

## 2. Impact of the European Groups

That changes soon took place was due to a number of factors. In the first place psychoanalysis, like all other sciences, is to some extent subject to the influence of fashion. It soon became the custom to see unconscious aggression in every analytic manifestation, and to speculate more and more on the organization of the ego prior to what had previously been called the Oedipus or incestuous phase of development, that is, roughly before the age of three and a half years. These tendencies were greatly fostered by an increasing interest in the direct psychoanalysis of children. The first child-analyst in England, Mary Chadwick, started her specialist work about 1922. Between 1925 and 1927 two courses of lectures were given in Great Britain by a Berlin analyst, Melanie Klein, who had also specialized in child-analysis. By that time child-analysis had become a recognized specialty in Britain.

In any case, it was natural that interest should be focused on early stages of development. For although the Oedipus phase between three and a half and five years of age had been fairly accurately mapped out and although some working generalizations had been established regarding mental function in the first eighteen months of life, the gap existing between these hypothetical reconstructions and the established findings valid for later childhood called for attention. Ferenczi of Budapest and Abraham of Berlin had done extremely useful work in this direction, but their formulations were not completely satisfying. The main problem remained unaltered, namely, what are the fore-stages of the super-ego, i.e., before that period at which it is obvious that its main function is to enable the child to wean itself from its Oedipus longings, frustration and dependence. For until the age of roughly two and a half years, when it is first possible to establish a rudimentary “psycho-analytical situation” and thereby to check theories of mental development by direct psychoanalytical investigation of children, all such theories are of necessity based on hypothetical reconstruction and therefore give play to subjective factors. Obviously this state of affairs was calculated to give rise to dissensions and controversies, in which these subjective factors were bound to play an increasing part. And this is in fact what happened. A controversial period in the development of the British Psycho-Analytical Society set in. This was greatly accentuated by the development of a new school of child-analysis founded by Melanie Klein, who by this time had settled in England.

The earlier formulations of this school were received on the whole with eager acceptance by most members of the British Society. This was no doubt in part a reaction to the previous absence of any very new or striking contributions to psychoanalysis from within the group; but it was due also to a genuine desire to see the gaps in knowledge of the early ego and of pregenital development filled up. Briefly, the new ideas included a number of legitimate extensions of the theories of Freud and Abraham, including the existence of early forms of super-ego and the role of introverted sadism in modelling these early forms. On the other hand, the new concepts already showed a distinct anti-Freudian tendency. A true Oedipus phase and a true super-ego were postulated for the sixth month of life and it was further maintained that libidinal positions or primacies are called out by struggles with the aggressive impulses, that is to say, the destructive impulses are more creative in effect than the libido.

These tendencies to deviate from accepted Freudian theory became quite obvious in the later formulations of Melanie Klein on the subject of depression (Klein, 1935). It was laid down that a “depressive position” is organized from the third month of life. This, it was maintained, is the result of a love-trauma due to the infant's imagined greedy destruction of a real loving mother whom it really loves. This depressive position is based on an earlier ‘paranoid position’ in which the child is believed to suffer from anxieties due to the projection of its own sadism. It was also stated that all neuroses are different varieties of defence against fundamental depressive anxiety. The developmental importance of aggression rather than of libido was reasserted and it was maintained that unconscious fantasies occurring in the first few months of life exercise a far-reaching and uninterrupted influence on the development of the mind.

The Freudian distinction between the unconscious system and the pre-conscious system was considerably blurred; the concept of narcissism was dropped in favour of an imagined system of 'internal objects'; and auto-erotism was regarded not as a narcissistic phenomenon but as a system of occult allo-erotic satisfactions in which the part of the body masturbated is actually an internal object representing a former external object.

Had these assumptions been valid, they would have involved a drastic revision of Freudian theory. But their sponsor had gone too far. Although many members of the British Society espoused her cause in a most devoted manner, open opposition developed in other quarters. This was strengthened when, after the Nazi invasion of Austria, a large number of the Vienna group, led by Anna Freud, settled in London. Opposition to the penetration of the Society with Kleinian views became more organized and for a time the Klein group dropped their earlier and bolder suggestions that Freud was just a little antiquated and old-fashioned. Nevertheless the important issue—whether students of psychoanalysis were to be trained in Freudian or Kleinian views—could not be buried. Discussions on the matter were just reaching a crisis when the Second World War put an end to them for the time being. The situation then was that the Society was divided, though not openly, into three groups: a classical Freudian group, a Kleinian group and a "middle group" whose members, whilst accepting some of the earlier ideas of Melanie Klein, felt that her later formulations went too far.

Looking back it seems somewhat remarkable that the Kleinian deviations from Freud should not have led to more drastic action. It is now clear that the tendency of the later Kleinian theories is identical with the tendencies of those earlier schismatics, Jung and Rank. The Klein group follows Rank in attributing mental development, and all variations in mental disorder, to a traumatic situation occurring, not, it is true, at birth, but shortly after birth; it follows Jung in attributing dynamic and developmental power to archaic fantasies. The fantasies attributed to the suckling by the Kleinians do not differ from the archetypes of "original sin" which Jung regards as a product of the (Jungian) "collective unconscious".

### 3. Post-War Development

Towards the close of the war, when members who had evacuated London or had joined the Forces began to return, the Klein controversy broke out again. For 18 months a series of discussions on the subject took place, but the result was inconclusive. Many ex-Viennese members, dissatisfied with the state of affairs existing in the Society, had transferred to the United States of America shortly after the outbreak of war, and this weakened greatly the influence of the Freudian group. Hence, despite shattering criticism of their views, Kleinian members retained their membership of the British Society. The Society, whilst nominally unchanged, split openly into two main groups: Kleinian and Freudian. A middle group sat rather timidly and uneasily in the centre.

After prolonged negotiations an attempt was made, not indeed to bridge the gap scientifically—because the differences between Freudian theories on the one hand and Rankian and Jungian ideologies on the other are scientifically

irreconcilable—but to found some system of training which would obviate an official split in the Society. This, roughly, is the state of affairs at the present time. Students are at first taught only Freudian theory but after the first year their training is taken over by two groups teaching respectively Kleinian and Freudian theory and practice.

This camouflage arrangement, however, does not alter the situation and whether in the future the Society turns Kleinian or Freudian depends for the most part on the numbers trained by the respective groups. Mainly, but not exclusively: for after the war a new influence began to make itself felt in the British Psycho-Analytical Society. This was, in the first instance at any rate, a matter of policy rather than of science, and involved an almost formal rapprochement between psychoanalysis and psychiatry. Before the war, psychoanalysis and psychiatry reacted to each other with an aloof disregard bordering on contempt. Psychoanalysis would in fact have nothing to do with any body that did not profess exclusively Freudian principles. Suggestions that a closer contact might be made even with more eclectic medico-psychological clinics, such as the Tavistock Clinic, were frowned on. The Society itself contained only a sprinkling of young psychiatrists who had so far contributed nothing to psychoanalytical knowledge.

During the war psychiatry made spectacular advances in administrative authority. For no particular reason except that of favourable opportunity, psychiatry became a positive craze in the combatant services; and naturally once the war was over a number of young psychiatrists, who had whetted their appetite on psychiatry in the Forces, evinced a desire for psychoanalytic training. The Society for its part began to overcome its earlier distrust of psychiatry. To cut a long story short: under the influence of its psychiatric members, plans were put into effect to train a number of psychiatrists; more remarkable still, psychiatric-minded analysts took up administrative positions in the previously non-analytical Tavistock Clinic, now the Institute of Human Relations.

This new development may in course of time influence the trend of psychoanalytical thought in Great Britain. Psychoanalysis in Britain was not, as in the United States of America, an offshoot of psychiatric activity. It derived its support partly from lay cultural sources and partly from doctors who before and after the First World War were interested in the Freudian approach to medical psychology. In short, it developed in the European tradition of psychoanalysis in which psychiatry, it is true, played a part but never exercised controlling authority. The older lay traditions of psychoanalysis, which Freud, although himself a physician, did much to foster, are thus threatened with extinction. On the whole it is not a very happy development and does not augur well for future progress in psychoanalysis. No doubt it will contribute to the general efficiency of psychoanalytic training, for most of the early medical analysts and all of the lay analysts in Britain were deficient in psychiatric training. Nevertheless the specialized and restricted outlook of the psychiatrist does not qualify him to assume a directing role in psychoanalysis; in other words, the average psychiatrist has neither the education nor the cultural background necessary for psychoanalytical research.

Simultaneously with the development of this psychiatric bent, psychoanalysis has begun to play a larger part in the

practice of child guidance. Unfortunately a new branch of "child-psychiatry" threatens to offset any advantages that might accrue from this logical and essential development of psychoanalytic work. For if psychiatry exercises a too highly specialized and too rigid influence on adult psychoanalysis, it is still less suitable to act as a regulator of child-analysis. It is indeed imperative that the specialty of child-analysis should recruit its members from the most broadly orientated, soundly trained and scientifically disciplined groups.

#### 4. Present Situation

With this brief survey of recent developments in the British Psycho-Analytical Society it is possible to indicate the present scientific status of psychoanalysis in Britain. The Society is now divisible into four groups: (a) an orthodox Freudian group, (b) a Kleinian group, (c) a psychiatric group and (d) the remnants of the old "middle group" to which reference was made earlier. The orthodox group is concerned chiefly with the maintenance of Freudian standards of training and education, particularly in the field of child investigation. The Kleinian group has not produced any new orientations, although already its influence is responsible for a growing tendency to take the psychology of "internal objects" for granted and to regard it as the most important factor in mental development. We shall, I think, soon see a 'schizoid position' added to the 'paranoid' and 'depressive positions' and 'manic defences' of early infancy already hypothesized by the Kleinians. No doubt in course of time most of these absurdities will be either watered down or eliminated, but in the meantime they constitute a threat to the scientific development of psychoanalysis in Britain. In other countries they have received no support and a good deal of overt criticism. The position of the third or psychiatric group has already been indicated. As for the fourth and rather nondescript "middle group", there does not seem much hope that it will survive very long. People with a fanatical enthusiasm for a special point of view exert, in any case, more influence than those who, out of a wish for compromise, keep to the middle of the road. And although there is no scientific virtue in compromise, yet a strong middle group does serve to restrain the exuberance of enthusiasts.

On the whole, therefore, one can only hope that the first or orthodox group will extend its authority. Freudian principles are still vital to the development of psychoanalysis.

A similar comment can be made regarding the therapeutic aspects of psychoanalysis. Psychoanalytic therapy is not, as is often thought, just a matter of free association and *ex cathedra* interpretation. It depends on the development during analysis of what is called the 'transference neurosis'. Starting with a spontaneous transfer of friendly (or hostile) infantile attitudes to the personality of the analyst, the patient gradually "transfers his neurosis" to the analytic situation, thereby rendering it more amenable to analysis and liquidation. When this is achieved the analyst sets about liquidating also ("analyzing out") the transferences. This is what distinguishes psychoanalysis not only from hypnosis and suggestion but from all other forms of "analytical" therapy or again from mixtures of

suggestion and "analysis". Unless the transference is adequately analyzed, the whole process of therapy, and whatever therapeutic results may accrue, depend on a state of infantile rapport, in other words they partake of the essential nature of suggestion. Naturally the 'transference neurosis' occurs in classical form only during the psychoanalysis of the psychoneuroses, hysteria and the obsessions, which for that reason are often called 'transference neuroses'.

During the war, when military necessity dictated the use of short cuts in diagnosis, treatment or selection of personnel, a number of old methods were resuscitated and given more pretentious names; hence the use of 'hypno-analysis', 'narco-analysis' and at a later date 'group-analysis'. It is often assumed and sometimes explicitly stated that these constitute "advances" in psychoanalysis. The fact is, however, that they constitute merely advances in the technique, respectively, of hypnosis, narcosis and 'transference therapy'. They add nothing to our knowledge of psychoanalysis proper and in fact act as obstacles to the carrying out of classical analysis. Whether they produce results more quickly remains to be seen, and is in any case beside the point. No one ever suggested that an analysis should be evaluated by temporal measures. And as Freud, anticipating that some time or other necessity would lead to a mixing of methods, once remarked: the quickest way to carry out an analysis is to do it properly, i.e., in accordance with psychoanalytical principles. No doubt psychoanalysts have tended to neglect Freud's conservative views on the therapeutic applicability of psychoanalysis to cases indiscriminately selected, and have only themselves to blame when, goaded by the intractability of many non-neurotic cases (e.g., character disorders, psychoses and perversions), they hanker after quicker methods. But it is inherently unlikely that any method which canalizes rather than analyzes the transference will in the long run prove more efficient or permanent in effect than psychoanalysis proper.

But when all is said, the present is an interesting phase in the history of psychoanalysis. However absurd some of the hypotheses recently advanced may have been, there is no doubt that the focusing of interest on problems of early ego-development and on the organization of mind during the phase of 'primary identification' (i.e., at the stage before the 'self' and the 'not-self' are accurately differentiated), will in the long run produce results of value both diagnostically and therapeutically. It will involve, as I have suggested in my 'theory of nuclear development of the ego', a molecular rather than a 'gestalt' approach to the subject; or rather, it will involve a distinction between rudimentary and organized gestalt-patterns of the unconscious (Glover, 1932a, 1932b, 1933, 1943).

What psychoanalysis needs in the future is what it has always sorely needed, an accession of scientific workers, who must, it is true, be able to conduct therapeutic analyses—that is essential—but also whose interest in research or in the formulation of new theories is disciplined by scientific controls rather than regulated by "intuitions", which are often little more than subjective reactions. If psychoanalysis could rally to its ranks the numbers of young, intelligent and imaginative men and women who flock to the service of physical science, progress in research would no doubt be spectacular. But alas for the prospect, the budding physical scientist may make a good academic or laboratory

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## PROGRESS OF PSYCHOANALYSIS IN GREAT BRITAIN\*

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- 1 History of psychoanalysis in Great Britain
    - a Methods of training
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### 1. History of Psychoanalysis in Great Britain

The interest of several pioneers in psychoanalysis, of whom Ernest Jones was the chief, led to the formation of the London (now British) Psycho-Analytical Society before the First World War. In 1913 it was affiliated to the International Psycho-Analytical Association. In 1919 Jones, who was President of the Society until 1943, founded the International Psycho-Analytical Press for the purpose of publishing books and journals. In 1924 the Institute of Psycho-Analysis was constituted in London as "a company not for profit" with memorandum and articles of association giving wide powers in clinical and scientific matters

\* [See also article by Edward Glover in this number (BMB 1297).—Ed.]

and the legal power to receive bequests but not to distribute profits. The Institute provided a clinic for the treatment of needy patients, and a library and courses of training were also inaugurated. One of the Institute's first functions was to take over the International Psycho-Analytical Press, and arrangements were made to carry on the work of publishing books and the *International Journal of Psycho-Analysis* and its supplements. The Journal has been issued continuously since 1920.

The Institute of Psycho-Analysis is therefore an organization which deals chiefly with external relations, with publications, with training and with the maintenance of a clinic, The London Clinic of Psycho-Analysis. The British Psycho-Analytical Society is concerned solely with organizing meetings, held bimonthly, for the discussion of scientific matters; its membership in 1948 consisted of 72 medically qualified members and associate members, and 35 non-medical members and associate members. Associate members are elected to full membership when they have made a contribution to the theory or practice of psychoanalysis.

#### *a. Methods of Training*

Perhaps the most important function of the Institute is that of training future psychoanalysts. The plan of training is similar to that organized by other psychoanalytic training institutes elsewhere in the world, and consists mainly of three parts. A student begins his training by undergoing a personal analysis, and then, usually after a few months, he is ready to start attending lectures and seminar courses in theory and practice. The didactic courses continue throughout three academic terms for three consecutive years. Some time after commencing didactic work the student begins the psychoanalytic treatment of patients, under the supervision of senior psychoanalysts. Supervision continues for two years.

When trained to the satisfaction of the Training Committee, the student is proposed for associate membership in the British Society of Psycho-Analysis. The last annual report of the Institute states that 59 students were in training in June 1948, 42 of whom were medically qualified. The main scientific background of the non-medically-qualified students is in psychology, sociology or biology (some students at the Institute being medical students at the time of their psychoanalytic training).

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psychologist but he does not as a rule make a good psychoanalyst. Hence it is necessary for psychoanalytic institutes to go out into the highways and byways of cultural activity to seek promising recruits. These, when found, must be suitably subsidized to stand the financial strain of a combined psychoanalytical and medical education, and, later on, prevented by appropriate

rewards from choosing the path of professional success rather than the less lucrative road to scientific discovery. Psychoanalysis, which seeks to penetrate the mysteries of cultural development, must become and remain a cultural as well as a therapeutic or professional pursuit.

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Edinburgh and Manchester are the other centres in Great Britain where psychoanalytic work of any intensity has been carried on. For a period during the war there were sufficient psychoanalysts in Manchester to begin courses of training in association with the London Institute.

#### *b. Extension to other Fields*

During the early years of psychoanalysis in Great Britain most psychoanalysts were fully engaged in private practice and the only psychoanalytic treatment available, other than in private practice, was at the London Clinic of Psycho-Analysis. The early British psychoanalysts taught psychoanalysis chiefly by their writings, but occasional public or medical lectures, and the work of Forsyth, Hart and Stoddart at three London medical schools (Charing Cross, St. Thomas's and University College Hospitals) and the work of Professor Flugel in the Department of Psychology, University of London, had their effects. During the past 15 years the situation has changed. Several qualified psychoanalysts have begun work in fields other than psychoanalysis itself—in mental hospitals, in child guidance clinics, in psychiatric out-patient departments, and in a clinic associated with the Institute for the Scientific Treatment of Delinquency. Psychoanalysts have taken part in teaching, chiefly at the Institute of Psychiatry, Maudsley Hospital, the Tavistock Clinic, the Institute of Education, the London School of Economics (training course for psychiatric social workers), and at the Paddington Green Children's Hospital, all in London. One British hospital (the Cassel Hospital for Functional Nervous Disorders at Richmond) has, since its foundation, actively sponsored intensive psychotherapy and at present is the chief hospital in Great Britain where treatment is mainly psychoanalytical.

The foregoing is a brief survey and will be elaborated later in this article by a more detailed sketch of psychoanalysts' work in Britain.

Early in its history psychoanalysis attracted workers who later developed theories and beliefs incompatible with those of their colleagues. Such workers have resigned from the analytic organizations and have worked with other groups or formed their own groups. Outside Great Britain this happened with Adler, Jung, Rank, Reich, Stekel and others. In Great Britain such difficulties have been few in the history of the British Psycho-Analytical Society. The development of beliefs and interests divergent from those held by the Society led to the resignation of Miss N. Searl about 1937 and of Dr. Edward Glover about 1944. Searl had made important contributions to child analysis and to the psychopathology of early aggression—chiefly on the effects of screaming. Glover had for many years played an important role in the work of the British Society and had contributed perhaps most notably to the problem of ego development by his attempts to describe "primary ego nuclei"—the later integration of which leads to the formation of the infantile ego. Searl's resignation from the Society was based on the development of a predominant interest in parapsychology; Glover's was based on his belief that the divergent views held by different members of the Society were inimical to good scientific work and to the training of the next generation of British psychoanalysts. He disagreed strongly with the findings and views of many members of the Society regarding the origin of depression

during infantile development—findings which were first published by Melanie Klein in 1935.

## 2. General Clinical Activities

Before going into detail concerning those aspects of psychoanalytic work in Great Britain in which most progress has been made and where divergences of theory and practice are active, it may be well to broaden the description of work done by analysts in fields other than analysis itself.

Effective work by psychoanalytically trained workers has been most definite in the field of child psychiatry and child guidance. Bowlby's work (1948) on thieving in juveniles has demonstrated the inability of persistent offenders to form affectionate attachments. He has pointed out that in the vast majority of thieves with such inhibited affections there has been prolonged separation of child and mother during the first five years of life. Friedlander (1947) surveyed the problems of delinquency, as they are met in child psychiatry, in her recent book, *The psycho-analytical approach to juvenile delinquency*. The group working with Bowlby (who is in charge of the Children's Division of the Tavistock Clinic) are experimenting with the effectiveness of treatment by interviews of a psychoanalytic type held relatively infrequently, i.e., once or twice weekly.

The work of the late Susan Isaacs, through her position as a teacher in the Institute of Education, University of London, brought analytic principles to the fore. The great loss her recent death has been to British psychoanalysis will be only partly redeemed by her numerous clear expositions of psychoanalytic problems. After a period of work studying child development she became a psychoanalyst of children, closely associated with Klein. Her writings on the detailed role of infantile and childish fantasy-play in development will be a source of value for years to come (Isaacs, 1948).

Anna Freud and the group of workers associated with her have contributed valuable observations on childhood development as seen in deprived children later cared for by her and her colleagues in a London nursery during the war years (Freud, 1946; Freud, 1947; Freud & Burlingham, 1942; Freud & Burlingham, 1943).

Through their interest in child psychiatry the attention of psychoanalysts was turned to the problems of delinquency. In 1931 the Institute for the Scientific Treatment of Delinquency, London, was founded. From the first, several psychoanalysts were actively interested in this field and are continuing to work at the Clinic started by the Institute, now part of the National Health Service hospital organization.

Mental hospitals have attracted a few analysts. Stengel has continued to apply psychoanalytic principles to his work and has reported observations which could be made only on institutionalized cases of psychoses (Hemphill & Stengel, 1940; Stengel, 1945; Stengel, 1948; Stengel & Steele, 1946). At present, numerous students at the Institute of Psycho-Analysis are spending most of their time working in mental hospitals and it is to be hoped that a proportion of these will continue work with patients whose illnesses are so severe that treatment in a mental hospital is necessary. Most of the staff of the Cassel Hospital for Functional Nervous Disorders are either qualified psychoanalysts or students of psychoanalysis. This hospital

provides the one example in England where psychoanalytic treatment is being used in the in-patient field. Scott (1948) has reported his work with manic-depressive patients at this hospital.

In Great Britain (in marked contrast to America) none of the non-state-aided mental hospitals, where patients pay a fee approaching the maintenance charge and where over the years a very considerable endowment has often been built up, has as yet fostered psychoanalytic work.

The Second World War stimulated several psychoanalysts to work with groups of patients (Bion & Rickman, 1943; Foulkes, 1946, 1948; Foulkes & Lewis, 1944; Wilson, Doyle & Kelnar, 1947). The experimental work which Bion (1948) is continuing is perhaps the most interesting, in the sense that it attempts more fully to discover to what degree an analyst can contribute to the activity of a group of people seeking help if he adopts the same attitude to the group which he would to an individual patient.

At present, British psychoanalysts teach psychoanalysis only at the Institute of Psycho-Analysis. The last report of the Committee stated that 24 psychoanalysts were active in conducting personal analyses, and in supervision of students' psychoanalytic treatment of patients. Elsewhere, courses in normal and abnormal development in childhood, based on psychoanalytic findings, are given to teachers in training, to student psychiatric social workers and to other workers in the fields of child-care. Teaching in psychoanalysis as applied to psychiatry is unfortunately restricted to postgraduate training—none of the undergraduate medical schools at present has a psychoanalyst on its teaching staff, although Winnicott has for years taught the application of psychoanalytic principles to paediatrics at the Paddington Green Children's Hospital, London.

### 3. Recent Progress in Psychoanalysis

War, as most scientists agree, decreases the rate of scientific discovery, but greatly increases the rate of application of discoveries already made. It has had this same effect in the field of psychoanalysis. More than a quarter of the medically qualified psychoanalysts were engaged in applying their psychoanalytic knowledge in the wider fields of work into which they were drawn by the war, and of the remainder, few were able to continue analytic practice as intensively as before the war. Nevertheless, training at the London Institute of Psycho-Analysis continued during the war years and scientific meetings were held regularly. Luckily, circumstances allowed many of those senior analysts, whose contributions will be discussed shortly, to continue their scientific work.

During the early years of psychoanalytic work in Great Britain, most scientific meetings of the Society consisted of discussions and elaborations of the work of the European psychoanalysts. Nevertheless the five editions of the collected papers of Ernest Jones show how many original contributions to theory and practice were made in this country even in this early period (Jones, 1948).

#### *a. Child Analysis*

The fundamentally new theoretical conceptions and new aspects of practice which were brought before the British

Society were those of Melanie Klein. All, except her latest paper, are included in two books: *The psycho-analysis of children* (Klein, 1949) and *Contributions to psycho-analysis, 1921-1945* (Klein, 1948). Freud had early pointed out the importance of applying analytic understanding to the developing child, whether the child showed a neurosis or not. Several European workers, the chief of whom was Anna Freud, carried out psychoanalytic treatment of children, although some significant modifications were considered necessary, chiefly in the direction of fostering a positive feeling in the child for the analyst and in assuming to some degree the role of a teacher. Klein consistently attempted to modify the analytic situation in a minimal way, the chief modification being the provision of a room in which simple toys, a couch, chairs, a table, a sink with water, etc., were present. She showed how, by the observation of children's play, a technique of psychoanalytic treatment could be developed as early as the third year; and further, that the analyst could maintain the same attitude to the spontaneous play of the child as he habitually did to the verbal productivity of an adult during analysis. It became apparent that a child would accept this situation, just as the adult, as Freud had discovered, accepted the analytic situation. It was found that the sequence of activity or play, whether it included much speech on the part of the child or not, could be understood and interpreted to the child in such a way that his subsequent behaviour or speech gave indications of the correctness or the falsity of the previous understanding and interpretations.

Work with children led to increased knowledge of unconscious mechanisms which are prominent during the first years of life. In particular the increased knowledge of introjection and projection mechanisms, of infantile omnipotent fantasies and of the almost lifelong importance of 'object relationships' led not only to an increased understanding of the child, but also to a realization of the implications of these mechanisms in the neuroses of later life. The implications of such mechanisms for an increased understanding of adult and childhood psychoses, especially manic-depressive psychoses, may in the long run be a most important stimulus to further research in treatment.

#### *b. Aggression and Origins of the Super-Ego*

The extension into infancy of problems which had previously been thought to begin first in childhood has led to a review of the origins of the Oedipus complex and of the origins of the super-ego. Much evidence has been accumulated to show that the father or his substitute appears as a rival for the breast and that the father (or his substitute) is taken by the infant as an early source of substitute gratification when the mother frustrates the infant. Both these factors lead to the development of the infantile triangular situation, when oral love and oral hate are dominant and before genital feeling comes to play the predominant role that it does during the next few years, during which the classical genital Oedipus complex develops. Interrelationships between aggressive and libidinal activities from the earliest age had to be assumed, as continued work with infants and children (and later, work with adults whose illnesses were severe and in many cases psychotic) accumulated. Problems began to arise in the analytic situation which previously had been recognized only in

severe psychoses; in some cases these problems could be beneficially affected by continued analysis.

Considerable divergence of opinion regarding the origin of aggression still persists. Klein considers that the intensity of infantile aggression is such that it can best be understood as evidence of the correctness of Freud's formulations of a "death instinct" which is projected on to frustrating objects in order to preserve the ego. Although many continue to accept Freud's view, others try to understand infantile aggression in terms of an instinctive response to frustration of libidinal wishes, either by environmental agencies, or by sources originating within the body. Others try to understand the content of aggressive activity as a disorganization of libidinal activity in the presence of non-satisfaction, whether the source of the non-satisfaction lies outside or inside the body. By the death of M. P. Middlemore, British psychoanalysis lost a keen observer, but not before she had published observations of the variability of initial satisfactory and unsatisfactory sucking activity (Middlemore, 1941). A continuation of her work should help to solve some of the problems regarding the relationship between libido and aggression.

### *c. Origins of Depression*

Perhaps the most important theoretical formulations introduced by Klein, which have been confirmed by many analysts, concern what she at first called 'the depressive position'. Fundamentally it was an extension of the previous work of Freud and Abraham to a point where the connexion between normality and abnormality is easily seen, and to a point in development where grief and depression are first added to the earlier emotions of love, hate and fear. Before this there had been great difficulty in describing how any individual came to develop what can only be called the normal human capacity for disappointment, sorrow and grief.

The following outline attempts to picture the problem as it is seen by many British psychoanalysts today. To put simply how disappointment can arise for the first time, it is necessary to describe how the infant develops to a stage which allows disappointment to appear. Regardless of what view is held about the source or nature of instinct, it is obvious that from an early age the infant breathes air, sucks milk, passes water and stools, moves about, and sleeps. These activities may be generally satisfying. If any are unsatisfactory, the infant becomes angry. Regardless of how severe or wide-spread his anger may be and regardless of how many organs he uses to vent his anger, he will first show his rage in the unsatisfied part; for instance, if breathing is unsatisfactory, he will breathe angrily; if sucking is unsatisfactory, he will suck in rage. From the earliest age each pleasant or angry activity has a direction, namely, an interchange between what comes to be called later the outer and the inner world—the infant breathes in or out, he swallows or vomits.

Only slowly in the infant's developing scheme of things are "people" included in the form in which he will know them later in childhood. Earlier his world consists of what he will later know as parts of people—breasts, faces, hands, etc. Equally slowly is a knowledge of a "self" as a whole person or other people as whole people developed. Only slowly are the distinctions which are later called sen-

sations, illusions, images, memories achieved. Somewhere along this line of development crucial points may be noted and at one of these crucial points disappointment and depression become possible for the first time.

To describe adequately the onset of depression some aspects of the sequences just mentioned must be given in more detail. Hunger may lead to sucking a breast and to experiencing pleasure. Through the acts of breathing, sucking, smelling, touching, swallowing, the feeling of a "good" something going into the inner world occurs; in the literature of analysis this something is usually referred to as an 'object'. During or following such a pleasant experience, the infant may empty his bladder or bowel, or sleep with pleasure, and may as yet not clearly appreciate that there is an object associated with the experience of evacuation. Nevertheless there is a beginning realization that an exchange between the outer and inner worlds, and between the inner and outer worlds, can occur and that it can be good.

On the other hand, hunger may not be followed by a satisfying, pleasant sucking. Instead it may be followed by bellowing and gnashing of toothless gums, by a spreading rage, and by the emptying of bowel and bladder during this rage. The accompanying feelings appear to be that a "bad" interchange is taking place between the inner and outer worlds, and any differentiation between 'objects' in either the inner or outer world is into many "bad" objects. Such a fit of rage may of course be followed or interrupted by a satisfactory experience, but such a satisfaction will be different from what it would have been had not a bout of anger preceded it. Such experiences are repeated many times in slightly different forms during development. The series of pleasures, dissatisfactions and rages leads, on the one hand, to memories of the inner and outer world in which infantile fantasy of a loving type has had free play, and, on the other hand, to memories of infantile hateful experiences in which persecutory feelings are important.

Sooner or later sufficient integration occurs for the infant to realize that the memories of the loving, satisfying breast and the hating, frustrating breast are of one and the same breast; and that the happy sucking mouth and the angry, frustrated, hungry mouth are the same mouth. The time of such an event will vary with the degree of maturity at birth, with the intelligence of the infant and with the quality of his previous emotional development, but often occurs during the first year.

This realization—that maximal love and maximal hate can be expressed by the same bodily organ and can be felt towards the same object, and that this object can be both satisfying and frustrating and can appear to be both loving and hating—is one of the crucial points of development. On analysis, feelings of disappointment and depression and grief and guilt all appear to be different ways of discussing the implications of this crucial phase of development. If this new feeling of depression is tolerated, if the belief is that love is greater than hate, and if love can be used to overcome, to annul, or repair the effects of hate, the infantile type of resolution of disappointment and depression occurs and the way is laid for the development of a normal appreciation of the varieties of human experience that are to appear during the later stages of development. On the other hand, an incomplete tolerance of this situation may

lead to the many forms and symptoms of abnormal depression of all degrees of severity. If rage and hate are something greater than love, if the memories of the many hateful acts, impulses and fantasies outweigh those of love, then there arise hopelessness and depressive anxieties connected with the belief that only bad can be done and only badness is to be expected of one. At its extreme, this may lead to a situation in which the ego will have to be destroyed to protect anything that is good or anybody who is good from one's own badness and rage. The self may be destroyed actually in suicide or symbolically in a temper tantrum or a fit.

Gradually, as more integration occurs, the belief in a whole continuing self and in whole continuing people leads to the multifarious variations in the conscious conscience and the unconscious conscience; these in turn give rise to the series of changes which lead to the formation of the adult super-ego. Gradually more details of the origins of the super-ego in the early introjections of loved and hated objects are becoming apparent.

The behaviour and speech of the depressed person demonstrate his attempts to discover more satisfactory ways of dealing with the more or less conscious realization that his hate for the same person is greater than his simultaneous love for that person, without at the same time denying that it is he himself who both loves and hates or that it is the same person whom he both loves and hates. At the period when such an integration first occurred, the predominant impulses, facts and fantasies were connected with the mouth and respiration, but nevertheless activities of other organs played a role. Although from a very early period of life

some organ systems play a predominant role, the fact that all organ systems which later can reach consciousness in their functioning also play a significant role has much to do with the finding that the symptomatology of depression has so many ramifications in the personality.

The scheme just outlined, when applied to the complex symptomatology of infantile, childhood, adolescent, adult or senile depression, has added greatly both to the understanding and treatment of depression.

#### 4. Future Prospects

Further work is naturally leading to an interest in the types of disorganization or dissociation or splitting seen in various schizophrenic states or in schizoid personalities, and active discussion concerning these mechanisms is going on in the British Society at present. In the background there are problems which are only beginning to be attacked, namely, masochism associated with various types of organic disturbance, narcissism, and the complicated states of defect and the serious types of schizophrenic inhibition and disorganization. Behind all such interest in new problems stand two facts. The first is the large number of students who are willing to spend sufficient time and energy to equip themselves with an adequate training to co-operate later with their teachers. The second fact is the inroad which psychoanalysis has begun to make into the understanding of sequences of behaviour unassociated with many words—as is so often the case in interviews with neurotic children and with psychotic adults and children.

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## THEORIES OF THE ACTION OF PHYSICAL METHODS OF TREATMENT IN PSYCHIATRY

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The last twenty years have witnessed a profound revolution in the treatment of the mentally ill. On the one hand there is wider knowledge about human motives and psychogenesis. This has led to the recognition of the importance of emotional tensions within the family and in marital and group relationships, which, while they may contribute little or nothing to our knowledge of the psychopathology or structure of the severer psychoses, nevertheless throw much light upon precipitation and prognosis. On the other hand, technological advances in biochemistry, physics and electronics have promoted an era of experiment, based upon speculation about the somatic aspects of mental disorder.

### 1. The Different Methods and their Values

It has been said (Lewis, 1945) that there are many physical methods used in psychiatry besides the induction of convulsions, insulin coma and frontal leucotomy. These three and their modifications, however, share characteristics which separate them from continuous sleep, malarial or penicillin therapy, thyroid administration, and many others. The latter treatments have a rationale based on the known etiology of the condition treated. They are directed most specifically at a pathogenic agent, faulty metabolic events, or as symptomatic treatment to allay the vicious circle of anxiety and its physiological accompaniments. The three first-named techniques—generally called “shock” treatments—are, however, empirical and have been developed

from theories, already proved erroneous, about the pathophysiology of mental disorder. All involve the production of unconsciousness in the patient: all are potential threats to the patient's life and carry attendant risks: all produce, but in varying degree, profound changes in the central and autonomic nervous systems.

The value of such treatments in the large range of functional psychoses is undoubted. Statistics abound which demonstrate the value of insulin comas in schizophrenia, of convulsion therapy in the depression of later life, and of prefrontal leucotomy in all manner of conditions. In the last named, the statistical evidence is less weighty, although the Board of Control Report (1947) carefully assesses the results of the first 1,000 leucotomy operations in Britain. Many eminent observers have ascribed their good opinion. Thus, Sir David Henderson in his presidential address to the psychiatric section of the Royal Society of Medicine said:

I at least am satisfied from my personal experience, and no one can rob me of it, that in leucotomy we have a means of benefiting many persons to such a degree that, irrespective of a failure here and there, a great advance in the treatment of otherwise intractable conditions has been effected.

Dr. Desmond Curran at the conclusion of the Croonian lectures (1948), which he devoted to the subject of prefrontal leucotomy, and the manuscript of which he has kindly allowed me to see, said:

Remarkably few people are worse for the operation and if it is felt that in many instances the best that is achieved is a poor one it will be found that such a view often arises from an inadequate appreciation of the deplorable state and prognosis of the preoperation condition. In many instances the best that is achieved is very good indeed.

Although there appears to be general agreement that insulin comas are of value in schizophrenic states and only in them, there is much less specificity for the other methods. Thus, convulsion therapy is known to produce remission not only in depressive states but also in some schizophrenic illnesses, and the operation of prefrontal leucotomy has been performed with benefit in schizophrenic, depressive and obsessional states. Numerous attempts have been made to isolate the personality types, the constellation of symptoms, and the various factors which enable a selection of the correct treatment to be made for the individual patient. Nevertheless, despite these efforts, physical treatment in psychiatry remains for most patients an experimental procedure and often patients are subjected to each method in turn. Posterity may well consider that these treatments, in their present form at least, are very crude and that the patients' nervous systems are subjected to unnecessary traumata. Research will in time very probably alter this; the techniques as we know them may well be superseded by measures which bear no outward resemblance to those in use today. Nevertheless, it is clear that in the massive organismal insults to which patients are at present subjected, there lie hidden some therapeutic principles, which act upon known or unknown psychological or physiological mechanisms and which it should be our earnest endeavour to discover.

The possible approaches to this subject are necessarily predetermined by the conceptions concerning human behaviour, normal and abnormal, held by the investigator. “Explanations” of the benefits of, for example, convulsion therapy vary from the “purely” psychological to the



"purely" physiological, with many intermediate theories. In the present state of our ignorance none can be neglected, although it is always necessary to consider such formulations against the background of what is known with certainty about the etiology of the psychoses. The subject offers a wide variety of approaches. In the first place, the important modification in techniques instituted in recent years has thrown some light upon what is essentially therapeutic, and what unnecessary, in the treatments. Next, studies of the psychological and physiological characteristics of the patients benefiting can be compared with similar studies of those not benefiting. Thirdly, the immediate psychological and physiological effects of the treatments may be examined; and fourthly, a search made for any lasting effects in the patients resulting from the various procedures.

## 2. Modification in Technique

Two tendencies are at present discernible. In the one, a greater refinement of technique leading to less damage to, or interference with, brain functions is apparent. In the other, the attack upon these functions is more massive and the immediate physical and psychological effects more profound. Thus, on the one hand we find the development of limited forms of the leucotomy operation, or of ways of inducing convulsions with the minimal dispersion of electrical energy in the brain; on the other hand, the advocacy of prolonged insulin comas, of multiple convulsions within the space of hours or days, of prolonged electro-coma and of the largest leucotomy cuts. These divergent tendencies probably only reflect the present uncertainty regarding the mechanisms of action. More important, however, is the increasing realization of the unspecific therapeutic effects of the treatments in themselves. Thus, it is now common practice to combine insulin comas with induced convulsions, and there is increasing emphasis upon the importance of psychotherapy in both treatments.

### *a. Insulin Coma Therapy*

While there is no specific treatment for schizophrenia, the benefits of Sakel's hypoglycaemic technique (Sakel, 1935, 1938) in promoting remissions, particularly in the early cases, is undoubted. There have been few important modifications in this, the first of the "physical methods", in recent years. Modified insulin therapy, in which smaller doses of insulin are used and the hypoglycaemia is terminated before coma, has been extensively used for correcting the physical effects of emotional exhaustion, in promoting rehabilitation in the acute neuroses seen in war and in creating a favourable atmosphere for psychotherapy, but it has no place in the treatment of schizophrenia, or other psychoses. In these it seems necessary to induce comas. Most observers favour prolonged comas (Horwitz & Kalinowsky, quoted by Wilcox, 1948; Sargant & Slater, 1948), and many comas, even when improvement begins early in the treatment (Freudenberg, 1947).

Convulsions, either induced by the electrical method or by metrazol, are recommended as adjuvants by many. These are given either before the insulin coma or during the early stages of coma, and are particularly valuable in the first year of the illness (Sargant & Slater, 1948). It is, of

course, known that both treatments individually prove increasingly ineffective as the duration of illness lengthens. Increasing importance is placed upon psychotherapy during insulin treatment. In fact, there is doubt whether the active interest in the patient, that is, the positive therapeutic atmosphere of the insulin unit, is not more important than the somatic effects of coma. There can be no doubt that the frequency of remissions rises significantly when the treatment is given by a clinician who devotes his whole energies to the insulin unit, who combines active psychotherapy and social and occupational rehabilitation with the formal production of comas every morning. Levy & Perry (1947) recommend sessions of psychotherapy under sodium amylal narcosis three times a week during the course of treatment. The common observation of the greater rapport which can be obtained with the schizophrenic immediately after recovery from his morning coma, together with the importance given to psychotherapy, may well lead to the conclusion that the mechanism of recovery after insulin coma lies in the production of a state in which the patient is prepared for psychotherapeutic help.

### *b. Convulsion Therapy*

Variations in the characteristics of the electrical current have been made to find the best method of inducing a convulsion with minimal transmission of energy to the brain, to minimize the mental confusion and memory changes following the convulsions and to reduce the initial jolt to muscles and bones which is consequent upon the fact that maximal stimulation occurs at the start of the standard Cerletti-Bini technique. The instrument developed by Strauss & MacPhail (1946) delivers a measured stimulus with a condenser discharge which is interrupted by a high speed oscillator. The pulses can be arranged to be either monophasic (uni-directional) or diphasic (alternating), but the initial pulses are maximal and decline as the condenser discharges. Therefore the tonic phase of the convulsion is still maximal at the start. Nevertheless, the convulsion is milder, recovery is more rapid, and there is less confusion. Liberson (1947), Wilcox (1948), Tietz (quoted by Wilcox, 1948) and others have experimented with variations in the duration of each stimulus, and in the number, time and grouping of stimuli. These have been fully reviewed by Wilcox (1948). In the Wilcox-Reiter technique, monophasic 60 cyc./sec. current is used with short intervals between each pulse and larger intervals after each three pulses (50 msec.). This gives about 35 groups of pulses every second. The pulse amplitude is much less than in the Cerletti-Bini technique, but is itself modulated; the total duration of stimulation is about ten times longer. The amount of energy dispersed in the brain is therefore much less. Instead of electrodes on both temporo-frontal regions, the positive electrode is placed upon the vertex and the negative upon the temple. With this method, Wilcox finds that the memory changes are much less, that the persistent changes in the cortex, as shown by the electroencephalogram (EEG), are also less and that apnoea is reduced to a minimum, although the therapeutic effects are no less than with the standard technique.

Liberson (1948) introduced a modification of stimulus duration. Using 120 sec. square waves of brief duration (0.5-0.7 msec. compared with 8-10 msec. for the other

methods) with a total duration of 1–1.5 sec., convulsions are induced with an even smaller dispersion of electrical energy in the brain. Liberson claims even less memory disturbance from his technique, but the patients have greater fear of the treatments in consequence of the reduced amnesia. Occasionally the patients awaken before the convulsion is over and for this reason Liberson recommended a pulse duration of at least 0.5 msec.

Tietz (1947), Medlicott (1947), and Paterson & Milligan (1947) have utilized electrical stimulation to produce a prolonged tonic spasm, suppressing the motor effects of the clonic phase and by continuing the stimulation at a lower level, maintaining the patient in a state of unconsciousness, misnamed "electronarcosis"—a better term would be "electro-coma". In this technique, the current rises slowly from zero to 200mA, a level below that used for convulsion, in 1 to 3 sec., and this level is maintained for 30 sec. The current is then slowly reduced to restore respiration, after which it is raised again to 110–140 mA. After 7 minutes it is slowly reduced to zero, after which the patient regains consciousness. The advocates of electronarcosis claim that confusion and memory changes are less than with the standard convulsion techniques, but admit that dread of treatments may be serious.

Initial cardiac arrest occurs in both these techniques, but secondary bradycardia occurs only in electronarcosis. The subsequent later tachycardia continues longer in electronarcosis and the rise in systolic and diastolic pressure is greater and persists longer. Bowman & Simon (1948) emphasize the importance of the "suppressed" clonic phase in electronarcosis, believing it to be important in the therapeutic effect. They doubt whether the results, without this phase, would be any better than those obtained from the "petit mal" reactions of "missed" electric convulsions, which are known to be minimal. They question whether the therapeutic results would not be equally good if the current were turned off at the end of the 30 sec. initial period. The intensive convulsion therapy (4 treatments a day) advocated by Milligan (1946), Kennedy & Anchel (1948), Tyler & Löwenbach (1947), Thorpe (1947), and Geoghegan (1946) for psychoneurotics, manics and schizophrenics produces a profound confusional state with incontinence and a delirium resembling the post-traumatic state. This illustrates a tendency away from those efforts, already cited, to produce minimal brain damage or dysfunction. The complete non-specificity of the cases treated, and the uniform confusional state induced, suggest that the efficacy lies in the masking effect of the latter. It is as yet too early to know whether these massive insults to the brain will find a place in psychiatric therapy. Clearly the effects go far beyond those produced either by the standard electro-convulsant method or by electronarcosis. No proper appraisal of the physiological or psychological aspects has yet appeared, and statements alleging the absence of risk must be accepted with caution.

Some of the minor modifications in the technique of giving convulsions, aimed at reducing complications, are relevant. Curare, which reduces the motor convulsive activity, prevents the rise of venous pressure; the inhalation of oxygen minimizes anoxia but has no effect upon the efficacy of the convulsions. When anxiety and apprehension are reduced by barbiturate sedation or abolished by pentothal anaesthesia, the treatment remains effective.

On the other hand, the methods of mechanical restraint in common use, including elaborate jackets which must enhance anxiety, have equally little effect upon efficacy. Subconvulsive stimulations, utilizing the Reiter and Liberson techniques with different electrode placements, are reported by Wilcox (1948): Amnesia for a few minutes, followed by confusion, has no therapeutic action. Such stimuli through the frontal poles produced anxiety, but if combined with preceding stimuli to Brodmann's area 38 to produce amnesia, some clinical improvement occurred, though this was not comparable with that after the full convulsion.

### *c. Prefrontal Leucotomy*

In the original operation performed by Almeida Lima of Lisbon in 1935, at the suggestion of Egas Moniz, the object was to sever as much as possible of the white matter in the frontal lobes in a plane just anterior to the frontal horns of the ventricles. This object was pursued by Freeman & Watts in America and by McKissock, Radley Smith and other neurosurgeons in England. Until recently Freeman (quoted by Mayer-Gross, 1948) has aimed at the greatest possible severance. The clinical effects of this procedure, apart from any amelioration of the psychosis, are those of frontal lobe damage described after head injury. Mayer-Gross (1948) has summarized them concisely:

In the emotional field: euphoria, fatuous equanimity, absence of finer emotional response, rudeness and tactlessness; in the motor field: hyperkinesia, restlessness, distractibility; and in thinking: turning towards the 'concrete', impairment of 'synthesis' and lack of insight. After leucotomy these symptoms may be much milder than after gross cerebral injuries in clinical material; but the difference is only one of degree.

Other immediate but transient effects are bulimia, disturbance of memory and retention, apathy or lack of emotional inhibition.

A contrary view of what determines the therapeutic effect has led to the experimental trials of partial or selective cuts of frontal white matter, producing a local severance of certain cortical areas from their projection nuclei in the thalamus. A vertical cut, "isolating" the orbital surface, is advocated by Dax & Radley-Smith (1943, 1946, 1948), Hofstatter, Smolek & Busch (1945) and Reitman (1946) for the emotionally apathetic, dull, introverted patient. The efficacy of this orbital leucotomy is believed to be due to the development in the patient of the symptom triad of euphoria, hyperactivity and extraversion—a syndrome known to occur after orbital cortex ablations and lesions. Dax & Radley-Smith (1943) believed that, on the other hand, the upper section cuts reduced psychomotor overactivity. It is possible that these partial effects, which obviously have therapeutic significance, contribute to the total picture of the frontal lobe syndrome produced by the total operation.

The disturbing results of too great a destruction in the brain have led to other partial forms of the operation. Freeman (1948) now favours the transorbital approach proposed by Fiamberti, which severs only those fibres in the frontal polar regions, thereby isolating cortical areas 9 and 10. Actual excision of the frontal poles has been performed at open operation by other workers, as well as undercutting of the cortex and "topectomy", "areaectomy" or "fractional resection" of cortex, with minimal interference with white matter. At the International Congress

of Psychosurgery in Lisbon, 1948, Wycis, Freed & Spiegel demonstrated a stereotaxic instrument used for producing partial destruction of the dorsomedial nucleus of the thalamus by an approach from above. The rationale of this procedure lies in the fact that this is the main thalamic nucleus projecting to the prefrontal cortex.

The difficulty of relating the clinical results of a blind operation, in which partial or selective cuts are attempted, to actual topological lesions has been clearly shown in the fine neuroanatomical studies of Meyer and his collaborators (Meyer & Beck, 1945; Meyer & McLardy, 1947, 1948, 1949; Meyer, McLardy & Beck, 1948). The brains of 95 patients dying after leucotomy have now been examined. Meyer & McLardy (1949) state: "The variability of the leucotomy cuts, which was first demonstrated in 1945 . . . is still an impressive finding in cases operated upon in 1946 and 1947." In fact, the surface markings on the scalp bear little constant relation to brain areas beneath. From detailed analysis of the lesions found in their material, and by correlation with the personality changes following the operation, Meyer and his collaborators have not been able to relate lesions in any one cortical area to specific effects upon personality, although there was some evidence that the orbital sector is more important than any other. They were able to show, however, that personality changes persist after bilateral lesions long after the process of active repair is completed. The degree of personality change would appear to be related to the extent to which the thalamo-frontal projection fibres are severed, rather than to severance of any specific sector of these fibres. It is of interest that posterior cuts, involving the cingular, posterior orbital and pre-motor regions—areas concerned with autonomic functions—have undesirable clinical effects, which suggests that a disturbance in the autonomic integration plays little part in the mechanism of improvement. These studies suggest a quantitative relationship between amount of prefrontal cortex isolated, personality change and clinical improvement (Frankl & Mayer-Gross, 1947). If this relationship is found to be valid, the stereotaxic operation upon the dorso-medial nucleus of the thalamus would receive its rationale in cases in which maximal interruption of thalamo-prefrontal fibres is indicated, although the obvious difficulties and dangers inherent in the technique will probably preclude its extensive use.

Turning now from the modifications of the actual operative technique to the general problems of the operation as treatment, we find much the same attitudes towards this, as towards insulin therapy. The operation in itself is almost the least part of the treatment; a prolonged course of re-education is necessary. Mayer-Gross (1948) recommends prolonged convalescence in hospital and warns that where no facilities for re-education of the patient exist, no operation should be performed. Others recommend persistent pressure and urging of the patient to re-adapt, with punishments if he fails to do so.

### 3. Psychological Evidence

Evidence regarding the immediate psychological effects of these treatments is of course meagre, since the patients retain, for the most part, a total amnesia for the experience of the shock. This applies particularly to convulsion therapy and leucotomy. It has been postulated from the

point of view of psychodynamics that "shock" techniques constitute such a threat to the ego's existence that it is freed from guilt by an act of atonement, and thereby strengthened. Against this must be placed the evidence that measures designed to reduce anxiety and awareness to a minimum, or to abolish them altogether, e.g., by pentothal anaesthesia and barbiturate sedation, have no known effect upon the therapeutic efficacy. In this connexion Sands notes that among 50 cases of attempted suicide he had seen, it was noticeable that while many neurotic and psychopathic patients improved following their attempts, the patients with psychotic depression remained suicidal risks as much as before. "Atonement had not been achieved whether consciousness was lost or not, yet in convulsion therapy it is the psychotic depressions who gain while the depressed neurotics and psychopaths show indifferent results." (Unpublished paper: see p. 41, section 5.)

The psychological phenomena of insulin coma parallel the progressive depression of metabolic functions down the neuraxis, with depression of each level resulting in release and overactivity of each immediately lower level—a dissolution of the hierarchical control in Hughlings Jackson's sense. This, in psychological terms, means regression. The progressive disintegration from psychological to motor, to reflex and to autonomic levels of functional organization is seen in reverse during the recovery from coma, and it is when the highest levels still show some depression of function that the patient shows the euphoric, "drunken" behaviour which enables the therapist to achieve contact with him.

#### *a. Effect on Intellectual Functions*

There can be no doubt that all the physical methods of treatment under review produce some alteration in intellectual capacity, although in varying degree. The maximal effect on memory functions is probably produced by convulsions, with insulin comas and leucotomy producing only slight changes. In a few cases, Brody (1944) found measurable defects eighteen months after conclusion of electroconvulsion therapy (ECT). Loss of retentive memory immediately following, and throughout the course of ECT, with recovery within a few weeks after conclusion, can be found in most cases. The current attempts to reduce these memory changes to a minimum reflect the view that they are not significant in the therapeutic mechanism. In the case of ECT, at least, the intellectual changes which, besides memory defects, include dullness, lack of attention to personal habits, and apathy (Salzman quoted by Wilcox, 1947) are regarded as complications of the treatment, not intrinsic to the recovery mechanism. They are greater in the elderly and in the arteriosclerotic. Similar observations have been made both upon insulin-treated patients and upon those who have had prefrontal leucotomy. The confusional state which immediately follows the application of all these treatments is often of the greatest duration following leucotomy, but is probably proportional to the degree of frontal damage, being greater where complete section of white matter has been attempted (Dax *et al.* 1948). The typical expressions describing the symptomatology have been summarized by these workers: "Patients tend to be emotionally shallow, easily influenced in mood and act, lacking in reticence, outspoken throughout,

rude and tactless; introspection is impossible; they lack initiative; egocentric and irritable; have defective foresight and live in the present." From this state, which describes the frontal lobe syndrome familiar after head injury, there is gradual improvement. Reitman (1946, 1948) considers that the partial lower cuts introduced by Dax & Radley-Smith (1946), which tend to isolate the orbital cortex maximally, produce changes—consequent upon the brain damage in these areas—which are most beneficial for those patients with introversion, lack of initiative and shallowness of affect. This view is contrary to that held by Frankl & Mayer-Gross (1947) and is not substantiated as yet by the neuroanatomical studies of Meyer and his collaborators already cited. In their view the resulting mental changes depend upon the amount of prefrontal cortex isolated, rather than upon the selective isolation of special areas. On the basis of this theory, Frankl & Mayer-Gross state:

The surgeon will be asked to produce enough frontal symptoms to combat the symptoms of psychosis—enough euphoria against distress and depression; enough extraversion and distractibility against introspection and withdrawal; enough indifference and freedom from care and worry against obsessions, delusions and fear.

#### *b. Late Personality Changes*

While the immediate after-effect of all three treatments is to produce confusion and some intellectual changes of the type which follows brain injury, it is believed that after a short period the majority of patients treated with insulin or ECT completely recover from these effects. Standard tests of intellectual function, weeks or months after leucotomy, also fail to reveal persisting defects. Yet there can be no doubt that, especially after leucotomy, a fundamental although subtle change has occurred. This can be described only in the emotional field. Brody (1947) found that while his patients showed no impairment on being tested with a battery of standard tests of mental ability given before and six weeks, four months, one and two years after operation, yet there were among them many patients whose spontaneous intellectual activity did not, from observation, reach the level and quality proved, by the tests, to be within their capacity. Brody suggests that the test situation evoked some drive not ordinarily operative after leucotomy. This observation is substantiated by the common finding that ideas and delusions, held with great emotion before the operation, are still present after it but "stripped of emotion". Freeman & Watts (1942), Hutton (1947), Reitman (1947a), and Hutton & Bassett (1948) have described these emotional changes in detail. There is an indifference to criticism, to their own feelings and bodily functions, and to the feelings of others. Consequently there is less reserve and shyness. While still intellectually aware of moral and ethical principles, and unlikely to transgress them, such principles are held objectively. There is less "uplift, altruism, creative spirit, soul or whatever else one would like to call it" (Freeman & Watts, 1948). These subtle but profound alterations in the affective life of the leucotomized patient do not occur in those subjected to convulsion therapy, nor are they obvious in those treated by insulin, although here the problem is beset with the great difficulty that the schizophrenic, in whom alone insulin comas are induced, is already affectively dulled as a result of psychosis.

#### 4. Physiological Evidence

Many investigators (Gellhorn, 1943; Himwich, 1944; Meduna, 1945) have been impressed by the similar physiological effects of the various shock treatments. Similarities are seen in alteration of some blood constituents, of cerebral oxidation mechanisms and in the effects upon the autonomic nervous system. Theory regarding the significant common factor is divided between cerebral anoxia (Himwich, 1944; Meduna, 1945) and alterations in the excitability of the autonomic nervous system (Gellhorn, 1943). It is emphasized that the bodily response to the therapeutic agent, rather than the agent itself, is the significant factor. These responses are understood as adjusting or homeostatic mechanisms called out to preserve the internal environment of the body. The changes which occur immediately in the therapeutic convulsion—hyperglycaemia, fall in  $\text{CO}_2$ , increase in lactic acid, acid shift in blood pH, stimulation of the sympathetic-adrenalin system—are seen in the second stage of insulin shock therapy. Meduna (1945) relates the similarity of the blood changes in the shock therapies and in diabetes to the fact that certain schizophrenics behave like diabetics in their response to the insulin tolerance test, and suggests that the diabetic-like behaviour of the schizophrenic patient in this respect is but an unsuccessful defence against the disease. He further suggests that all treatments, to be successful, must interfere with the enzyme systems of carbohydrate metabolism.

The view that cerebral anoxia is the operative factor in insulin and convulsion therapies is not, however, universally held. While anoxia is certainly profound in hypoglycaemia, Gellhorn (1943) brings evidence against its importance in ECT. Clearly the brain suffers anoxia during the convulsion because of the respiratory embarrassment, but from direct observation of the vessels vasoconstriction has not been reported. The decrease in arterial oxygen tension found by Himwich (1944) during the convulsion does not occur in curarized animals maintained by artificial respiration (Libet, Fazekas & Himwich, 1940). More important from the point of theory is that techniques aimed at reducing apnoea to a minimum do not diminish the therapeutic efficacy (Wilcox, 1948). The outstanding common factor present in the two treatments is considered by Gellhorn (1943) to be the increased excitability of the autonomic system, particularly the sympathetic-adrenalin system. Hyporeactivity of the organism's defences, which are provided by the sympathetic-adrenalin system and relative preponderance of the vago-insulin system, is, perhaps, one of the most important substantiated physiological findings among schizophrenics. In insulin hypoglycaemia there is progressive depression of function in the central nervous system but progressive excitation of activity of the autonomic system, with preponderance of the sympathetic-adrenalin activity. Moreover, it is believed that only those patients who produce an increased amount of adrenalin during treatment respond satisfactorily. In electrical convulsions a profound excitation of the central nervous system occurs, as well as stimulation of the autonomic system, which again affects the sympathetic more than the parasympathetic centres. Gellhorn (1943) has found evidence that the hypothalamus shows an increased excitability which may continue for hours after metrazol convulsions in animals.

In prefrontal leucotomy we are clearly dealing with a

different situation. The general effects on the nervous system, apparent in the other treatments, are not present, but some changes in autonomic activity have been described (Reitman, 1947b; Rinkel *et al.* 1947), although the findings are not consistent. After an initial hyperreactivity of the autonomic system in the weeks following operation a more stable and unresponsive homeostasis is later reached, according to Reitman. Rinkel and his colleagues, however, report that the autonomic system becomes more responsive to external stimuli after leucotomy. Stimulation of the carotid sinus produced bradycardia, slowing of EEG potentials, loss of consciousness and tonic-clonic convulsion in 88 per cent of patients operated upon. Similar sensitivity was found among patients who had received ECT. Clearly the changes in autonomic functions require further investigation in leucotomized patients. At present the emphasis lies on the amount and site of the isolated prefrontal cortex, which are regarded as the significant therapeutic factors.

The importance attached to the change seen in the autonomic system has again directed attention towards the diencephalon. Delay (1946), Murphy & Gellhorn (1945b) and Wilcox (1948) subscribe to the theory that the site of action of the therapeutic convulsion lies in this area. It is improbable, but not excluded, that excitation of peripheral autonomic pathways plays any part. Murphy & Gellhorn (1945a) provide good evidence of the effects which excitation of hypothalamic centres have on cortical functions independently of the peripheral autonomic pathways. The direct route is from the sympathetic centres in the hypothalamus via the dorsomedial thalamic nucleus to the cortex. Widespread excitatory effects on the spontaneous electrical activity of the whole cortex, as shown by the EEG, and facilitation of motor, and probably sensory, functions follow stimulation of sympathetic focal points in the hypothalamus. Studies of the changes in cortical function in these treatments, as shown by the EEG, have been frequently made. The depression of cortical activity during hypoglycaemia and during the stage of clinical exhaustion after ECT is shown by the presence of generalized slow waves in the EEG. In insulin hypoglycaemia the changes are progressively towards slowing, but during the electrical convulsion the EEG reflects the maximal excitation of cortical neurones. Slow activity in the prefrontal areas, rostral to the leucotomy cut, is seen for some weeks after the operation. In each method—hypoglycaemia, convulsions and leucotomy—the amount of disturbance in the EEG following the treatment is proportional to the persistent cortical dysfunction, and probably reflects the degree to which the intellectual functions are impaired. Unfortunately for theory, the changes in the EEG cannot be related to the process of recovery from the psychosis.

### 5. Clinical Approach

The immense literature makes it abundantly clear that the selection of the appropriate treatment and the decision as to whether any given patient is likely to respond are dependent upon factors other than the nature of the mental disorder present, or the nature of the treatment proposed. While it is still generally held that hypoglycaemic coma is the treatment for schizophrenia and, more firmly, that ECT is specific for some depressions (Sands, in a paper read at the Royal College of Physicians International

Congress, London, September, 1947; Sargant & Slater, 1948), the recent literature suggests that leucotomy is beneficial to both types of patient. Indeed, the indications for success by physical methods would appear to cut across diagnostic categories as we at present know them (Fernandes & Polonio, 1946). Symptoms rather than diagnostic syndromes may well determine the choice of a particular treatment. This is emphasized by the advocacy of ECT for the mental symptoms of organic disorders such as general paralysis of the insane after the appropriate specific treatment has been given.

The expectation of a favourable response to any method is, in the last resort, a variable dependent upon the expectation of recovery if no treatment were given. This, of course, is not to deny the efficacy of physical methods, which the writer considers to be beyond question. At the present time the symptoms of depression with agitation, diminished psychomotor activity, mild confusion and catatonic stupor or excitement, lead to the administration of ECT. Insulin comas are usually given to patients suffering from thought disorder of schizophrenic type, in the absence of the above symptoms, or after failure of ECT to produce a remission and provided that for other reasons, such as the duration of illness, a remission can still be expected. Leucotomy is advised for those patients whose main incapacity lies in chronic obsessional tension or in chronic paranoid pre-occupations and delusions. Usually, however, leucotomy is carried out after the failure of other methods to produce a remission. Nevertheless, all are agreed that in established hebephrenia, where the prognosis without treatment is well-nigh hopeless, none of the physical methods is of any avail. Mayer-Gross (1948) says in this connexion: "... hebephrenics showing only lack of initiative, affective blunting and facetiousness are themselves too akin to the frontal syndrome to permit any improvement after operation."

From the formulation of a patient's total situation—the process which constitutes psychiatric diagnosis—the physician is confronted by three main avenues of therapeutic approach. In the first, the environmental stresses are reviewed and every effort made to remove, or at least reduce to a minimum, their noxious effects. In many instances these are of the greatest significance, but it may not be possible to alter them. In the second approach, the physician reviews the effect which environmental stresses, past and present, have had upon the patient and considers to what extent such effects can be changed. This constitutes the field of psychotherapy. In the third and last approach, the constitution of the patient, i.e. his machinery for adaptation, is considered. It is here that the physical treatments probably act. The clearest exposition of the rationale of the constitutional approach is provided by Sargant & Slater (1948).

Causation in psychiatric disorder—as indeed in the whole of medicine if symptoms are considered—is always multiple. A primary cause may be present, as for example in general paralysis of the insane or in Huntington's chorea and in some cases of simple schizophrenia where the hereditary factors are prepotent. In the majority of functional psychoses, a primary cause is usually not detectable; nevertheless, it is necessary to try to decide which factors constitute predisposing causes, which precipitating causes. The latter are not necessarily psychogenic, nor physiogenic,



in the exogenous sense. The loss of a love-object or an attack of influenza may precipitate a depression, but age is the most important precipitant of involutional melancholia. The physical treatments probably affect the organism's situation by modifying the organism's constitution. It is, therefore, for those conditions in which constitutional weaknesses are etiologically prepotent that such methods are found of greatest value. The assessment of the patient's constitutional strengths and weaknesses is one of the hardest tasks of the psychiatrist, whose efforts are bent on weighing up the multiple factors, genetic, physiogenic, psychogenic, intrinsic and extrinsic, which the history reveals. In the broadest and simplest terms, the constitution can be regarded as the organism's machinery for dynamic adaptation to the world. Predetermined in part by genetic factors, its manifestations are nevertheless always subject to change from bodily disease, trauma, or to the operation of hitherto unexpressed genetic deficiencies liberated by, say, the factor of age. Little enough is known about this machinery. Age, physique, intelligence, temperament—these are qualities of discernible significance.

The central nervous system maintains our immediate relationship with the external environment, and the autonomic nervous system safeguards the all-important stability of the *milieu intérieur*. The evidence relating changes in autonomic function to the treatments under consideration has already been reviewed. Clinical observation of the patients adds further data. Increase in weight occurs during insulin therapy, after ECT and after leucotomy. Appetite is splendid, sleep is sound, and there is "a greater freedom in demeanour and bearing" (Frankl & Mayer-Gross, 1947). Sargant & Slater (1948) advise that the patient receiving insulin comas should continue until his physique has returned to normal. "Mental improvement and physical improvement usually go side by side . . . If the patient regains his normal weight and physical state, and retains his mental symptoms unaltered, it is a bad sign, and it is usually not worth proceeding further." During the hour or two after recovery from insulin coma the patient's skin is flushed and glowing, and he is warmer and friendlier in his manner to the doctor and nurses. The change in the affective attitude is very prominent, lasts progressively longer after each coma as the treatment proceeds, and is a characteristic of those patients who recover.

## 6. General Conclusions

The main problem with which the treatment of the functional psychoses presents us is not so much to alter mood, or to eradicate thought disorder, but to offset the secondary psychological effects which result from prolonged illness. The schizophrenic, for example, is faced with progressive social incapacity, loss of volition, and decreased affective resilience and responsiveness. The longer the patient has been removed from active participation in the dynamic life of society and family, the less likely it becomes that he will ever regain his social capacity. The greater the duration of his illness, the more profound the isolation of the patient from normal contact with his fellows, the more serious the resultant "scarring" of the personality will be. In a sense, therefore, every psychosis calls for

emergency measures to reinstate the patient in a normal relationship with his environment before some critical time, after which the chance of doing so greatly decreases. In the case of schizophrenia, we know that this remains good in the first six months, becomes poorer up to two years and thereafter is slight. No known physical or psychological therapeutic technique can add positive qualities to a personality which did not possess them before the illness began. Indeed, prefrontal leucotomy usually deprives the patient of certain qualities with which, and perhaps because of which, he has failed to adapt. These losses may be permanent, but of this we are uncertain. The problem is similar to that often encountered after severe cerebral trauma to the frontal lobes. The psychological evidence shows no comparable losses after ECT and insulin comas. Follow-up studies of patients treated indicate that insulin and ECT do not alter the probability of second or further attacks occurring, but there can be no doubt that the duration of illness is considerably reduced by these treatments. Moreover it has been repeatedly emphasized that the quality of remission is better than if no physical method had been used. The results are much better if a full programme of re-education, psychotherapy and social activities is carried out during and after treatment. This has received increasing emphasis from those engaged in treating large numbers of patients. The remission rate from the insulin treatment of schizophrenia was increased from 46 % to 79 % when these principles were adopted (Bond & Rivers, 1942). Mayer-Gross regards re-education as essential after leucotomy, and states that the operation should not be performed unless it can be assured.

At the present time, in the absence of real evidence of specific effects from these treatments, it is reasonable to assume that by their use the patient's constitution is temporarily altered in such a way as to render him open to a variety of re-educative processes. The importance to be placed upon these is greatest in the case of insulin hypoglycaemia and prefrontal leucotomy, less in the case of ECT. This is understandable since the patients who respond to ECT are those with the stronger, better balanced constitutions. In them the balance of the processes determining the quality of the affective tone has been temporarily disturbed. The constitution, given the necessary stimulus, re-equilibrates rapidly and shows once more the resilience which was previously observable in the patient's personality.

The precise manner in which the constitution is altered by these methods remains an intriguing but obscure problem. The strictly psychodynamic theories do not receive any support from the technical data. It is increasingly probable that the treatments act immediately by modification of physiological activities, but these in turn promote an altered situation in which psychological factors become of the greatest significance. Thus, prefrontal leucotomy, by producing the frontal lobe syndrome, creates a total psychological integration which is less complex, and re-introduces a state of plasticity of adaptation in which the patient is open to re-education. Insulin hypoglycaemia and ECT both produce unconsciousness and a variable period of mental confusion after the treatments in which, again, the patient's emotionally determined attitudes are altered. But this is not all. In hypoglycaemia it is the comas, and in ECT the actual convulsions, that are necessary to thera-

peutic efficacy. The arousal, stimulation and exercise of homeostatic defence mechanisms mediated by the sympathetic-adrenalin system may be, as Gellhorn (1943) has suggested, of therapeutic significance. The mobili-

zation of the somatic mechanisms of emotional expression may certainly be important in the treatment of those conditions in which affective unresponsiveness to the environment is a main feature.

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## SOMATIC ASPECTS OF MENTAL HEALTH AND DISEASE

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- 1 Psychosomatic interaction
  - 2 The influence of constitutional factors
  - 3 Somatic aspects of personality
  - 4 Physiological changes in emotion
    - a Skin reactions
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  - 5 Reaction to a metabolic stress
    - a Acute metabolic stress
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    - d Neurocirculatory asthenia
  - 6 Somatic factors in epilepsy
    - a Epileptic seizures
    - b Psychical seizures
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- References

The interaction of body and mind is a two-way process and under this heading must therefore be considered (i) the influence of somatic factors on the mental state and (ii) the influence of the mental state on bodily functions. Normally we are dealing with an interaction in which both are intimately interwoven, the body and mind working together as a whole.

### 1. Psychosomatic Interaction

The anatomical structures which may be involved in psychosomatic dysfunction include, on the motor side, the numerous ramifications of the autonomic and endocrine systems, which are controlled through the hypothalamus: on the sensory side are the visceral and somatic afferents and the chemoreceptor mechanisms concerned with the maintenance of homeostasis and with the different forms of appetite and drive. The integration of these mechanisms in the higher centres of the brain is as yet little understood; but it is clear that there is a continuous interaction between the somatic and higher functions and that this interaction is of such a kind that a dysfunction at any one level can give rise to a vicious circle involving the whole system. Thus, anxiety can give rise to symptoms which can in turn become a focus for further anxiety.

A physiological or metabolic stress may contribute towards a mental breakdown, the form of which will depend on predisposing constitutional factors, such as mental instability associated with an emotionally labile or a schizoid

personality. Factors such as septic foci or acute infections may aggravate the picture, while psychological frustrations and traumata deriving from unsatisfactory personal or sociological relationships may again be important as contributory or precipitating causes. The factors which appear to be significant in the causation of psychosomatic dysfunction may be considered under such headings as (i) genetic, (ii) constitutional, (iii) infective, (iv) endocrine, (v) metabolic and (vi) psychological. Such categories are not mutually exclusive, but may serve as a convenient method of approach. In many patients the mental and physical factors are so closely linked up that it is impossible to say which is cause and which is effect. Instead of the old question of whether a condition is psychogenic or physiogenic, it is generally more profitable to examine how much significance can be attached to the various contributory factors of each kind.

The view of multiple causality adopted in the present article has been expressed by Cobb (1947): "One must take a pluralistic point of view toward etiology and realise that many factors combine to bring about the concatenation of events which precipitates a clinical syndrome."

### 2. The Influence of Constitutional Factors

The effect of any somatic factor on the mental state depends partly on the physiological mechanisms through which it acts and partly on the constitutional make-up and personality of the individual concerned. The importance of constitutional factors in determining the mental reaction to a stimulus was recognized by Pavlov (1927), who observed that "the same influence may produce a profound disturbance in some individuals and show no trace of effect in others, according to the power of resistance of the nervous system in each case." He noted in his experiments on dogs that different animals often reacted to a stress in opposite ways, some becoming bold and over-active, while others became "cowardly" and inhibited.

This individual variation in the response to a stress is shown very clearly in more recent work on the production of experimental neurosis in human subjects by deprivation of vitamin B<sub>1</sub> (Williams & Mason, 1941; Jolliffe *et al.* 1939). Volunteers living on a diet deficient in vitamin B<sub>1</sub> were generally observed to become apathetic, irritable and quarrelsome, with loss of efficiency, as indicated by inattentiveness to detail and lack of manual dexterity in their work. Objective signs of deficiency were shown by ergographic and electrocardiographic tests. The experimental neurosis presented different forms in different individuals, depending on their previous personality. Some became markedly depressed, others hypochondriacal. In some, the chief symptoms were anorexia, lassitude and fatigue, the picture resembling that of anorexia nervosa, while others developed the breathlessness on exertion, giddiness, palpitations and precordial pain, which are seen characteristically in neurocirculatory asthenia, or "effort syndrome". The severity of the symptoms was augmented by physical activity and by cold weather. Recovery was rapid and complete when vitamin B<sub>1</sub> was given, with or without the knowledge of the subject. In some cases the recovery was marked by a subjective experience of unusual well-being associated with unusual stamina and enterprise, the subjects becoming more alert and attentive.

A similar individual variation in the reaction to a metabolic stress was observed in the starving population of Germany after the war. Of the patients referred to the clinics on account of starvation oedema, some showed anxiety and some were depressed, some became over-active, while others showed a schizoid withdrawal. Reactions of the "effort syndrome" type, with lassitude, breathlessness, giddiness and fatigue, were common. The condition was not remedied by administering vitamin B<sub>1</sub>, but it cleared up rapidly when a full adequate diet was given.

The importance of the previous personality in determining the manifestations of a psychosis is well known in the case of general paresis, which can take strikingly different forms. It is illustrated again in the recent work on the toxic psychoses produced by treatment with the antimalarial drug atabrine (mepacrine). About 0.1 per cent of all cases treated developed psychoses. In about a half of these the psychosis showed manic or depressive features, the manic reaction predominating, while in a quarter the psychosis was schizophrenic in type, the patients showing the usual catatonic, paranoid or hebephrenic features (Grieber, 1947; Perk, 1947).

### 3. Somatic Aspects of Personality

Recent work has confirmed to a considerable extent the early views of Kretschmer on the relationship of body-build and personality (see Rees, 1947). Physical constitution is determined largely by genetic factors, which may produce their effect to some extent through the endocrine mechanisms. These again bear a close relationship to personality, as illustrated by the well-known personality changes associated with dysfunction of the hypophysis, thyroid, adrenals, testes and ovaries (Reiss, 1944).

The genetic factors are mediated by the genes, which are generally believed to govern the enzymic make-up of the tissues, controlling the tissue metabolism and therefore the production of metabolites. Factors such as the rhesus agglutinin can be related to the action of particular genes and it is reasonable to believe that they play an important part in determining the individual variations in metabolic function which are found in almost any biochemical investigation of normal as well as of psychotic subjects. A few cases are known in which biochemical factors bear a relationship to personality, as in the tendency to hyperchlorhydria in the group of individuals subject to peptic ulcer; these constitute a fairly distinctive personality-type characterized by a worrying temperament and excess of drive.

The relationship of drive and instinct to somatic factors has recently been reviewed by Kubie (1948), who concludes: "There are no absolute distinctions between instincts and drives. The nucleus of each is a neuronal pattern which is partly inherited and partly acquired and modified through learning and conditioning." "All instincts consist of (a) the direct or indirect expression of biochemical body processes through (b) inherited yet modifiable networks of synaptic patterns which (c) are moulded in turn by superimposed, compulsive and phobic mechanisms." This is not incompatible with Freud's definition of instinct as "the measure of the demand for work imposed upon the mind in consequence of its connexion with the body."

Electroencephalographic studies have shown that the electrical rhythms of the cortex are almost as characteristic

of the individual as finger-prints, and particular traits such as specific forms of dysrhythmia often run in families. The alpha rhythm is easily blocked by fear, so that little is seen in tense and anxious subjects. Golla, Hutton & Walter (1943) used the blocking of the alpha rhythm as an indication of the type of mental imagery habitually used by the individual, and Hill & Watterson (1942) were able to identify two theta rhythms (one at 6 cycles/sec. in the parietal and another at 4 cycles/sec. in the temporal region) which could be correlated with a tendency to aggressive behaviour. Theta rhythm of this kind is common in young children but abnormal in adults: its appearance in aggressive psychopaths suggests a developmental failure in the maturation of the adult structure of the brain (Hill, *in press*).

### 4. Physiological Changes in Emotion

Emotion is associated with physiological changes which may affect the blood pressure, pulse rate, glandular secretions, blood sugar, and many other physiological functions, as well as the electroencephalogram (EEG). Cannon and his collaborators (*cf.* Cannon, 1915) built up a picture of physiological and biochemical changes in anger, fear, rage and pain, all mediated by the sympathetico-adrenal system and designed for the preservation of the individual in fight or flight; but in actual fact it is found that individuals differ considerably in their reactions to emotion and the responses do not conform to a uniform pattern of this kind. During air raids, for example, it was evident that while some subjects turned white when the bombs came down, there were others who flushed red in the face; while some became tense and hyperactive, there were others who felt faint; in some the discharge was mainly through the sympathetic, but in others through the parasympathetic division (Richter, 1945). If this variability is true of the physiological changes, it is likely to be equally true of the biochemical. The teleological views on the utility in fight and flight of these changes are unconvincing. The physiological changes may be regarded as attempts at achieving a readjustment of the individual to a new relationship with his environment. Sometimes they are beneficial but sometimes they are not.

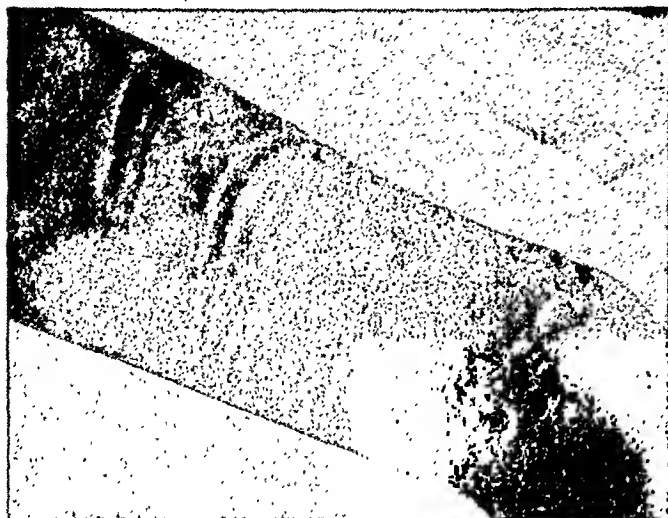
#### *a. Skin Reactions*

Besides the changes in the visceral organs, emotional excitement is accompanied by demonstrable changes in the blood capillaries, hair follicles and sweat glands of the skin. Of these the first two are supplied by adrenergic nerve fibres and are susceptible to the action of adrenaline, while the sweat glands are supplied by sympathetic nerve fibres which are cholinergic. The changes in the sweat glands in emotion are mainly responsible for the "psycho-galvanic reflex". There is also evidence of nerve fibres in the skin which can release a histamine-like substance and which have therefore been described as histaminergic.

The effects of emotional excitement on the skin are seen in reactions such as pallor, flushing, erection of the hair and angioneurotic oedema, the last being often localized in its distribution. This is also seen in many of the pathological skin reactions often described as psychosomatic. Cases have been described in which erythema and weals have been produced by hypnotic suggestion, and there are a few recorded cases of localized skin reactions produced

during abreaction (Harris, 1948). Moody (1946) has reported a case of some interest (fig. 1) in which rope-marks appeared on the arms during the abreaction of a patient

FIG. 1. PSYCHOSOMATIC SKIN MANIFESTATION



By kind permission of Dr. Moody and of the Editor of the *Lancet*

Photograph of right forearm with indentations and oedematous edges resembling rope marks, which appeared during abreaction

who re-lived an incident in which his forearms had been tightly bound with rope. The evidence indicates that the brain is able to retain the "memory" of a comparatively complex cutaneous motor pattern, which may be released at a later date by invoking an associated emotionally-charged complex.

#### *b. Changes in the Brain in Emotion*

The importance of the interactions between the cerebral cortex and the hypothalamus in emotion has been appreciated since the early investigations of Head (cf. Head *et al.* 1930). Recent work has extended our knowledge of the changes in the electrical rhythms of the cortex induced by emotion. Generally there is a reduction in the alpha wave frequency and an increase in faster frequencies, but the changes are not consistent (Hill, in press). In some cases there appears a stable rhythm at 20 cycles/sec. in the frontal and parietal lobes (Cohn, 1946).

Information about the metabolic changes in the brain has been obtained from animal experiments in which the biochemical changes in the brain are fixed by rapid freezing with liquid air. By this method it was found that the lactic acid content of the rat brain is significantly lower during sleep than in the normal waking state (Richter & Dawson, 1948a). In emotional excitement the lactic acid content of the brain is considerably higher than normal and over 300 per cent above the mean level for sleeping animals. Associated changes have also been observed in the phosphate esters and in other metabolites of the brain in emotion (Richter, in press).

#### 5. Reaction to a Metabolic Stress

The effect of a metabolic stress on the mental state depends on whether the stress is acute, as in a sudden

hypoglycaemic attack, or chronic, as in a vitamin deficiency extending over a prolonged period. In acute metabolic stress we are dealing with a direct interference with cerebral function; in chronic stress it may be hard to distinguish between the direct effect and the secondary reactions due to the repeated conflicts and frustrations which may be occasioned by the disability in everyday life. Here the form of the reaction is likely to depend to a much greater extent on the constitution, environment and personality-trends of the individual.

##### *a. Acute Metabolic Stress*

The reaction to a sudden acute metabolic stress causing a general impairment of cerebral function is frequently of the type described by Hughlings Jackson as "dissolution at the highest level". This reaction is non-specific in that it may be produced by a wide variety of conditions: these include anoxia, hypoglycaemia and various toxæmias. It may also be caused by a number of toxic substances such as carbon monoxide and many narcotic drugs which interfere with the metabolism of the brain. The reaction consists of a primary impairment of the highest cerebral functions, with loss of judgement and insight, impairment of intellectual ability and loss of emotional control, leading, through progressive stages of increasing confusion, to delirium and final unconsciousness. That the highest cerebral functions should be the first to suffer is understandable in view of the high metabolic requirements of the cerebral cortex. Along with impairment of metabolism goes a slowing of the electrical activity of the cortex and a lowering of the electrical potentials, leading finally to a cessation of electrical activity when unconsciousness has been reached and the cortex is completely out of action.

##### *b. Anoxia*

The mental changes in anoxia have recently assumed some importance in connexion with high-altitude flying. Emotional control and judgement are impaired by relatively mild degrees of anoxia; and as military flying is now often conducted at altitudes of up to 40,000 feet anoxia may occur, even when pure oxygen is being inhaled. The effects of anoxia on cerebral function, as indicated by the reduced performance of decoding tests and by impairment of vision, can be correlated with the changes in the EEG (Proger & Dekaneas, 1946). As the electrical activity is sensitive to biochemical changes in the cerebral cortex, it can thus serve as an indicator of the metabolic activity.

Impairment of visual discrimination is often an early sign of cortical dysfunction in anoxia. Engel *et al.* (1944) observed the occurrence of migrainous attacks accompanied by hemianopia or scotoma under high-flying conditions and they were able to show that the position of a scotoma could be correlated with the appearance of patches of slow delta rhythm, localized accurately to the corresponding visual-projection area of the cortex.

Even with an acute metabolic stress such as anoxia there is still a considerable variation in the individual response, which depends, amongst other things, on the basal metabolic rate; this is easily shown by animal experiments, in which the resistance to anoxia can be greatly increased by thyroidectomy. The effects of anoxia in producing "pilot error" are augmented by emotional over-breathing at high altitudes when expecting combat (Rushmer, 1944). Hypo-



glycaemia also exerts an aggravating influence: oxygen and glucose act in a similar manner on the brain potentials, so that the effects of anoxia can be offset by raising the blood glucose level. This has found practical application in the administration of glucose before high-altitude flying.

### *c. Prolonged Metabolic Stress*

Among the commonest reactions to a chronic metabolic stress are anxiety and depression, which may result from almost any physical or metabolic inadequacy to which the individual is unable to adjust. Anxiety and depression are not necessarily pathological; they may even be regarded as serving a useful purpose in so far as they help in adapting the behaviour of the individual to a physical disability because of which he is unable to cope with the demands of the environment. This was seen during the war in many cases of post-infective neurosis, in which the general debility after an acute influenzal or other infection interfered with the demands of military training and led to the development of an anxiety state.

### *d. Neurocirculatory Asthenia*

Among the reactions of patients suffering from chronic metabolic disorders is that described as "neurocirculatory asthenia" or "effort syndrome", since low tolerance of effort is often the presenting symptom. The symptoms are mainly referable to autonomic dysfunction and include breathlessness, palpitations, dizziness, chest discomfort and fatigue; in addition there may be anxiety, sweating, headache, trembling, and gastrointestinal disturbances (Jones & Lewis, 1941; Cobb, 1947). The syndrome has been observed in starvation, in vitamin deficiency and as a reaction to repeated hypoglycaemic attacks (Greene, 1944). It may be precipitated by an acute infection or by hyperventilation tetany. Jones & Scarisbrick (1942) have described the same syndrome in patients suffering from a type of metabolic disorder characterized by an abnormal rise in the blood lactate and a high oxygen requirement in the performance of physical work. Here again environmental and constitutional factors all play a part. The influence of genetic factors in determining the form of the reaction is indicated by the high incidence of neurocirculatory asthenia in the near blood relations of those suffering from the condition.

## 6. Somatic Factors in Epilepsy

Convulsions may occur as an unspecific reaction to a great variety of toxic substances which exert an irritant action on the brain.

### *a. Epileptic Seizures*

The metabolic nature of the disturbance in idiopathic epilepsy and the epileptic psychoses is suggested by the well-known effects of acidosis and sedation in preventing seizures and of hydration, alkalosis, hypoglycaemia and stimulation in precipitating them. The frequent association of epilepsy with abnormalities in the electrical rhythms of the cortex again points to a metabolic dysfunction; but dysrhythmia is often found in the normal relatives of epileptics, so that something more than dysrhythmia alone is needed to account for the occurrence of seizures. The biochemical factors determining the irritability of the brain

are not yet known; but it is suggestive that Pope (1948) and his collaborators have reported an abnormally high cholinesterase activity in epileptogenic zones of human subjects and monkeys.

The metabolic nature of the disturbance in *petit mal* is suggested by the action of glutamic acid, which is reported effective in some cases in reducing the incidence of the attacks (Price, Waelsch & Putnam, 1943; Waelsch & Price, 1944). Waelsch has suggested that glutamic acid may act by providing an essential unit needed for protein synthesis, but its action in *petit mal* epilepsy and in improving the performance of intelligence tests is not yet understood (Albert & Warden, 1944; Zimmerman & Ross, 1944).

Electroshock treatment and convulsant drugs cause a rapid breakdown of high-energy phosphate esters in the brain, leading to the utilization of carbohydrate and a liberation of lactic acid and inorganic phosphate (Richter, *in press*). Associated with these changes is a rapid liberation of ammonia, showing a direct action of shock treatment on the nitrogen metabolism of the brain (Richter & Dawson, 1948b). Ammonia is itself a cerebral irritant and it has been suggested that the ammonia liberated through stimulation may play a part in the initiation of convulsions.

### *b. Psychical Seizures*

Psychical seizures may take the form of hallucinations, "forced thinking", or ictal automatism. Any of these forms may end in generalized convulsions and may thus be said to become motor, although at the outset they are purely psychical phenomena (Penfield, 1947). Elaborate dream-like hallucinations are fairly common manifestations of psychical seizures and here the attacks can often be related to a focal electrical discharge in the cortex of one temporal lobe. The experience may be entirely visual, such as a vivid scene from the past, but there is usually some doubling of consciousness, with a realization that the occurrence is unreal. Penfield (1947) has described a case of a girl, subject to psychical seizures, in whom different features of her hallucinations could be evoked at will by stimulating precisely localized points of the temporal lobe when her brain was exposed under local anaesthesia. The points remained constant for each particular feature.

Psychical seizures can also take the form of "forced thinking", in which a feeling of compulsion to think certain unusual thoughts is the preliminary to a seizure. Stereotyped behaviour is often associated with a lesion in the frontal lobe and in one case Penfield was able to confirm by means of intracranial electrodes that a seizure was preceded by a unilateral spike-and-wave discharge in one frontal lobe, followed later by a period of flattening or "fatigue" in the EEG. This period, when the frontal lobe was presumably functionally inactive, corresponded to the period of automatism. The observations suggest that the mental confusion and abnormal behaviour of automatism are due to a temporary functional paralysis of a part of the brain (Penfield, 1947).

## 7. Somatic Factors in Schizophrenia

Schizophrenia is seen clinically as a group of psychoses differing widely in mode of onset, course and prognosis. It is difficult to generalize about a group which shows so little appearance of being homogeneous, but there are a

few physiological findings which apply to a high proportion of the patients included in this category. For the most part, these observations can be related to a dysfunction of the autonomic and endocrine mechanisms controlled by the hypothalamus.

It was pointed out some years ago by Pfister (1937) that the somatic changes in the early acute stage of schizophrenia are different from those in the chronic stage. Patients in the acute stage of motor tension and affective excitability are often over-reactive to stimuli, while those who have reached the chronic stage of apathetic disinterest are generally under-reactive to stimuli. It is thus necessary to define the clinical state at the time of examination, and particularly the degree of emotional excitement, as well as the diagnostic category. Failure to realize this has led to many contradictory results and misunderstandings.

The under-reactivity of the chronic schizophrenic observed by Pfister referred to (i) the adjustment of pulse-rate to posture, (ii) adjustment of blood-pressure, (iii) thermal regulation, (iv) the histamine response of the skin, (v) the water excretion after taking fluid, (vi) the blood-sugar response after taking fructose, (vii) the hyperglycaemic response to adrenaline and (viii) the response to insulin. This under-reactivity of the chronic schizophrenic has been confirmed repeatedly, and extended by other investigators to include many other similar functions. Hoskins (1946) mentions (ix) the thermal response to dinitrophenol, (x) the lymphocyte and adrenal response to cold, (xi) the nystagmic reaction to rotation in a revolving chair and (xii) the cardiovascular response to adrenaline. The evidence points to some kind of organic change at a hypothalamic level and also perhaps in the vestibular apparatus.

Evidence of the frequency of endocrine abnormalities in schizophrenia has accumulated since the early work of Mott (1917). Many different types of endocrine changes may be involved and these include dysfunction of the ovaries, testes, thyroid, pancreas, adrenals and hypophysis. The lack of specificity in the observed changes makes it unlikely that any single endocrine abnormality plays a dominant role in the etiology of schizophrenia: it has also been pointed out that schizophrenia is not particularly common

among patients known to be suffering from endocrine disorders. It appears likely that the endocrine changes in schizophrenia are again secondary to a primary disorder affecting the control of the neuro-endocrine system by the brain. If the view of multiple etiology is accepted, there may be cases in which an endocrine imbalance is a contributory or precipitating factor—puerperal schizophrenia may be a case in point.

The dramatic effect of agents such as sodium amylal in occasionally restoring certain schizophrenics for a brief period to near normality, points to a subcortical level as the site of the dominant lesion in these cases. This is also indicated by the prominent symptoms such as emotional incongruity, disorders of consciousness and lack of drive in the clinical picture of schizophrenia. The EEG shows no specific abnormality in the cortical rhythms in schizophrenia, but unspecific abnormalities are more common than in normal controls (Hill, in press).

Gjessing (1939) showed that the phasic changes in the mental state of periodic catatonics are associated with phasic changes in the nitrogen metabolism, and more recent work has extended this to include other metabolic functions. Both the mental and the metabolic changes are influenced by thyroid administration and in some cases by the nitrogen intake in the diet. The evidence is that the mental disturbance is closely linked with a cyclical metabolic disturbance which is presumably controlled at a subcortical level.

The importance of constitutional factors in schizophrenia is indicated by the reduced incidence in subjects of pyknic body-build (Rees, 1947). That the probability of developing schizophrenia rises with increasing closeness of blood-relationship to a schizophrenic emphasizes the importance of the genetic factors. In individual cases there is often evidence that acute infections and psychological trauma are significant as precipitating causes: the schizophrenic reaction has also been observed to follow organic head injury and the administration of toxic drugs. It would appear that somatic factors can play a part in the causation of schizophrenia, and that the hypothesis of multiple etiology agrees best with the facts available at the present time.

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## CHILD PSYCHIATRY

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- 1 Factors influencing the child
  - 2 Etiological roots
  - 3 Psychological and social problems
  - 4 Problems of child guidance
- References

In considering the history of medicine, we find each period of advance is rendered productive as a result of the fertilizing influence of one or other of the allied sciences. This is particularly true of the development of psychiatry. As general medicine has been reinvigorated by the aid of physics, chemistry and, later, sociology, so too has psychiatry been repeatedly dragged out of the rut by being attached to the strong and younger teams of neurology, psychology and the applied social sciences.

Although not obvious it is nevertheless true that child psychiatry, the youngest offshoot of psychiatry, has been affected by influences which go back for nearly two centuries. It would be historically blind not to admit the early influence of Rousseau and later of Pestalozzi, who, stressing the natural rights of the child and its key position in any society, awakened men's interest in the needs of the child as a creature having special capacities and growth potentials. As paediatrics became a special branch of medicine, clinicians came to realize the particular disorders of children not only in the symptomatic sense, but also in the field of metabolism, and the proneness of the child to certain metabolic nervous disorders produced at the same time an awareness of those other nervous disorders which arose from the child's helplessness and dependence on adults.

### 1. Factors Influencing the Child

Nevertheless, it seems to have taken a long time for paediatricians to realize that children have a mental life of a very special kind. Apart from the recognition of a different degree of intellectual defect, clinicians envisaged mental defect as the manifestation of gross disorders of the brain; in earlier days idiocy, feeble-mindedness and the like were regarded as clinical forms, rather than as grades of inefficiency. The functional view of defectiveness became possible only when Binet and Simon, tackling a purely educational problem thrown upon them by the inadequacy of teachers' class-room estimates, realized that a scale of efficiency was required which would have an objective

validity (Binet & Simon, 1911). As soon as mental tests were developed from their first efforts at analyzing the schoolchild's capacity, it was possible to see defectiveness as part of an imperceptible gradation from amentia to near genius. In fact, the normal frequency curve of distribution enabled other workers to look for the causes of differences within given age-groups. From this, it was only a step to Spearman's theory of two factors and rival hypotheses as to the nature of abilities in the totality of human intellectual output (cf. Spearman, 1927). Here was forged a new instrument of value to the child educationalist and psychiatrist. The significance of these researches to child psychiatry will be referred to again.

With the advance of neurology, another dimension was added to the study of the child mind by the special attention that was given to the study of aphasia and its relation to the apraxias, lefthandedness, mirror-writing and the special symbolism of arithmetic. Orton and his collaborators established the relationship between lefthandedness and stammering, which bore fruit in such scholastic studies as the difficulties of a child backward in reading and writing (Orton, 1937). The child handicapped in this way was later found to be the child struggling to keep up with class demands, which broke his morale and produced divers emotional repercussions.

Pavlov and his school (cf. Pavlov, 1941), and Watson (1924) with the behaviourists, began in their particular way not only to influence methods of study, but also to be influential in producing a more objective attitude in the study of behaviour, particularly in the earliest years of life. With the minimum of philosophical interpretation it was possible to observe the growing capacities of a child viewed entirely as a creature reacting to stimuli and yet reaching out to higher capacities under the influence of its maturing nervous system. By the observation of large numbers, behaviour charts for each year could be constructed, allowing for early diagnosis of defectiveness or, at least, of retardation.

But by these means alone the dynamics of child life could not be fully understood. The work of Bridges (1925) and others did indeed show that the child's emotions undergo modification and reorganization, but the inner teleology was not comprehended until psychopathology, in the hands of Freud and the derivative schools, added yet another dimension for the study of child life and mind.

Yet a third co-ordinate on which the life of the child depends is the social nexus. Since the time of Herbert Spencer it has been increasingly realized that the human subject derives his essential qualities not solely from the natural environment, but from the environment made up of other persons enjoying the same cultural and economic opportunities, and suffering the same restraints and frustrations that a relatively fixed social and economic structure imposes. The impact of cultural and economic forces has very special effects on the child. The parents are the transmitters of a social inheritance based on ideals of conduct and a tangle of prejudices. The socio-economic status of the parents in a class-stratified society imposes on the child advantages here and disadvantages there, varying opportunities of education, differences of space for living, sleeping and play, different degrees of nutrition. The characteristics, both mental and physical, of the environment affect the growing child in different measure,

from infancy to his entry as an adolescent into the open community life outside the family. These considerations are, of course, as important in adult life as in childhood, but the forces in the family as the first field structure, and in society as the extended field structure, in which the child behaves, exert special force because of the child's plasticity and dependence.

## 2. Etiological Roots

Reviewing these dimensional aspects of modern psychiatry, we can say that a full study of the child and its disorders can be arrived at only by a close inspection of four essential etiological roots: (i) the organic-biological, expressed in genetic endowments or defects, and the assaults upon this by disease or injury in early childhood; (ii) the psycho-biological, expressed in the unfolding, maturation, and inhibitory forces of the child body-mind displayed when we study the endowments of the child; (iii) the family influences which restrict the child's instinctual development; (iv) the social forces which the parents exert as cultural carriers, and which later appear in the social world of the community expressed through the school, the neighbourhood, and, later, in the still wider spheres of influence of society in general.

Recognition of these dimensions has been the basis of the team studies which make prognosis, diagnosis and treatment possible. There can be no one person who can carry the weight of, let alone manipulate, all the diagnostic instruments which this multiple approach implies. In any case, we need the initial skills of the paediatrician and neurologist to eliminate those systematic and metabolic disorders which have emotional and behaviour sequelae. For example, coeliac disease, with its debilitating and stunting effects, has frequent behaviour repercussions; epilepsy tapers off from major attacks to petit mal and episodic storms of temper and stuporose attacks. The electroencephalogram will doubtless, after further statistical studies, show us what types of dysrhythmia can be regarded as correlates of neural and mental symptoms. Encephalitis lethargica has a variety of mental sequelae, from minor changes of character to the grossest disorders of behaviour of an asocial and antisocial type. Disorders of the corpus striatus and thalamus, in which the presenting symptoms are not unlike hysteria, are known to present diagnostic difficulties, and temporo-parietal disorders have occasionally been the basis of obsessional-compulsive behaviour.

When we turn to the field of intelligent behaviour, we may, at one end, be confronted with organic brain states such as agenesis of the cortex or nodular sclerosis (deduced clinically or confirmed post mortem), from which, by the use of mental tests, we pass successively through manifestations of impoverished intelligence and average endowment to near genius at the other end. Special disabilities, such as agnosia or apraxia—of the nature of congenital imperceptions and of lack of capacity for symbolic thinking—make their appearance in delayed speech in early childhood or as scholastic handicaps in the schoolroom. This field is the proper study of the educational psychologist, skilled in the administering and interpretation of standard verbal and performance tests.

These two dimensions, neuropsychiatry and psychology, and their specialist team workers belong, as it thus appears, to the basal psychophysics of the affected child.

## 3. Psychological and Social Problems

The psychiatrist proper would appear to concern himself firstly with the broad study of behaviour and character in their devolutionary aspects. This is in the nature of an iconography of diseases or reaction types derived from the study of adult psychiatry. Nevertheless, although the young child, and certainly the adolescent, can suffer from disorders of conduct and thought analogous to the disorders of adult life, the child, in virtue of his immaturity and subjection to adult control, presents certain peculiarities which do not fall within categories of adult psychiatry; in fact, the latter may prove to be derivatives of the life and vicissitudes of childhood. Apart from the organic substrate, and assaults on the nervous system which, even in childhood, occasion dementia, obsession and early schizophrenia (dementia praecocissima), the early struggles of the child in its efforts to master instinctual discharges have shown us that an essential dimension for understanding emotional development and its aberrations can come only from the construction of a psychopathology which explains the moulding of the early years and the subsequent shaping of character and its deviations.

The main concern of the child psychiatrist today is to obtain such a careful case history as will give a general line of the development of the child in each instance. In the vast number of cases, such history-taking eliminates in the first place those organic diseases and disorders of nutrition which cause or aggravate behaviour disorders. This leaves a majority of children whose troubles are occasioned by gross mismanagement at the critical periods of life and/or are due to causes closely concerned in the intimate psychological unfolding of the child's instinctual life. This instinctual life—the satisfaction of fundamental interests—is woven into the child's relations with parents, brothers and sisters. Indeed, the child, at first one with its mother, gradually forms its own life of reaction under maternal tutelage. The early nutritional and excretional activities, and the controls exerted by nurture over these activities, subject the child to a variety of stresses and frustrations which lay down the first dynamic structures of character, or produce the first neurotic, and even psychotic, reactions. This constitutes the first layer of human psychopathology, and in it is woven the first evaluations of experience, good and bad, which form the moral and social nature of the child. Child psychopathology was at first derived from adult psychoanalysis; but inasmuch as these therapeutically designed studies revealed the childhood reactions of each patient, a child psychopathology was born which obviously called for checks, in the form of direct study of the disordered child. It is clear that adult analysis cannot be carried out on the problem child, and the very young child is hardly linguistically endowed to articulate its stream of memories and feelings. In the hands of Hug Hellmuth, Anna Freud and Melanie Klein a technique was evolved which used the language of the child, namely play; the aspirations, resentments, loves and hates are expressed in the fantasy revealed in play. It is claimed that this technique has confirmed much that has been learnt from the analysis of adults and has added new data, new emotional relations nearer the child's raw experiences before adult social reactions and obligations born of maturity or quasi-maturity have disguised and complicated simple patterns.

Although this play-technique is the radical instrument in the hands of child psychiatrists, it cannot be universally applied to the many that need it, because of the length of time required and the small number of skilled physicians available. Nevertheless, the discoveries made through its application to the few have given us clues for elucidating the problems of the many. The study of the life-story and presenting symptoms of the child treated by play analysis gives us indications of the mechanisms of other children not so analyzed. Psychopathology and social studies, linked together, give us a useful twofold instrument for the examination of problem children and problem families. That is to say, by social studies of family relations viewed broadly, and by inferences from psychopathology as to the difficulties of the individual child, we can act in an advisory capacity to parents by suggesting changes in parental technique; this means largely changes in parental attitude. It is said that the problem parent produces the difficult child. This partial truth may lead the psychiatrist from time to time to recommend psychological treatment of the parent rather than of the child. It is only a partial truth because parents may, within normal limits, have done well by their children, but in the early years of life it may well have been that the child, unable to tolerate frustrations imposed quite light-handedly, has constructed in fantasy a picture of his parents which cannot be easily accepted because of its mixture of good and bad elements.

#### 4. Problems of Child Guidance

This method of handling difficult children (and sometimes problem parents) has been designated Child Guidance, and is a technique which calls for a team effort of psychiatrist, psychologist and social worker. Largely advisory in aim, this technique is analytic and synthetic in method or means. It has a variety of problems to handle, and these can be roughly divided as follows:

##### A. Psychiatric and Educational

1. Problems of intelligence and education. Testing for special abilities, and for disabilities which cause educational difficulties and their behaviour repercussions.

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2. Problems of character and neurosis; these may have few family causes in the gross sense. The major problems are found to be:

(a) Disorders of functions of the body, which are expressions of emotional causes.

(b) Disorders of mental process—producing depressions, phobias, compulsions, separation anxieties, timidity and lack of capacity for co-operation.

(c) Disorders of behaviour, such as resentments, hostilities, temper tantrums, episodic flights from school and home.

(d) Disorders of a social nature, expressed in a variety of delinquent acts: pilfering, breaking in, damaging property; sexual abnormalities involving other persons.

##### B. Social

1. Problems arising from unhealthy milieu or economic distress.

2. Problems arising from gross breach of the family structure, i.e. loss of one or other parent by separation, divorce or death. To this must be added the psychological results of the stepmother or stepfather problem, and the dilemma of the adoptive mother. (The war has presented additional problems resulting from: evacuation, the new work and obligations thrust on mothers, the discontent and disillusionment of the father returned from war service.)

It will be obvious that all these situations are at one and the same time problems of the individual and of the primary family group, as well as problems of the family as a field of tension subject to the social tensions of the locality and the community.

In the technique of child guidance we are confronted by both these serious and interlocking problems, and also by great opportunities for clarifying those socio-psychological problems which, when solved, or at least scientifically tackled, will open new avenues for the study and advancement of human welfare.

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# JUVENILE DELINQUENCY

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- 1 Statistical data
  - 2 Causal factors in delinquency
    - a Innate factors
    - b Social factors
    - c Physical factors
    - d Mental and moral factors
  - 3 Treatment
- References

The Children and Young Persons Act, 1933, states: "No child under the age of eight can be guilty of any offence." It defines a "child" as a person who in the opinion of the court before whom he is brought is under the age of fourteen, and a "young person" as one aged fourteen and under the age seventeen. In criminal statistics both these groups are considered under the term "juvenile offenders".

## 1. Statistical Data

During the year 1945, the last for which figures are available at the time of writing, the incidence of crime in England and Wales in the age-group eight and under fourteen years was 22,922 males and 1,500 females. In the age-group fourteen and under seventeen the figures were 17,349 males and 1,732 females. The number of delinquents and criminals per 100,000 of the population at different ages or age-groups in both sexes was highest at the age of sixteen years. Thereafter the figures show a progressive decline. Although the juvenile delinquent is usually no more than a socially immature nuisance he may become a persistent offender and a menace to society unless his social, physical, mental and moral development is directed towards social usefulness. The methods adopted by Magistrates' Courts when dealing with juvenile offenders guilty of indictable offences have therefore special significance. In round numbers, the figures of disposal were as follows:

*Under the age of fourteen*, 41 per cent were placed under the supervision of a probation officer, 38 per cent were dismissed or bound over without supervision, 8 per cent were sent to Approved Schools,<sup>1</sup> and 11 per cent were fined. *Between the ages fourteen and seventeen*, 41 per cent were placed under the supervision of a probation officer, 26 per cent were dismissed or bound over without supervision, 11 per cent were sent to Approved Schools, and 19 per cent were fined.

<sup>1</sup> [Schools approved by the Secretary of State under Section 79, Children and Young Persons Act, 1933.—Ed.]

## 2. Causal Factors in Delinquency

The nature of juvenile delinquency is complex and may be the result of a combination of innate, social, physical, mental and moral variables.

### a. Innate Factors

There is general agreement with Burt's early statement (1925) that a criminal disposition is not directly inherited. Indirectly, the interaction between heredity and environment may establish a "crimogenic" disability manifesting itself through mental disease, mental defect or neuropathic tendency, or by character anomalies which adversely affect social life. Parental alcoholism, for example, as suggested by Young (1938) and others, is probably more often one of several alternate agencies having an adverse influence on conduct, rather than the specific cause of crime in the offspring, though some cases may be properly attributed to its exclusive influence.

### b. Social Factors

There may be little difference between the misconduct of a public school<sup>2</sup> boy and that of a boy from an elementary school. The former may be disobedient and the latter delinquent according to the correctional measures adopted, educational or magisterial.

Modern research has not materially altered the view that overcrowding, poverty and family strife may be causal factors among juvenile offenders. Bagot (1941) considered overcrowding was strongly associated with delinquency in Liverpool, and that it probably operated by driving large numbers of children into the streets when they should have been in bed. East, Stocks & Young (1942) found that of 4,000 male delinquents between the ages of 16 and 20, from the London and adjacent areas, 496 were 16 years of age, and that the person density per room of the habitation at this age was mostly below 2 persons per room. The density per room at 16 was significantly greater than at later ages, and it seems probable that the density below this age would be still greater.

Burt (1925) found 16 per cent of delinquent children from the London area belonged to families who were definitely on the poverty line. Bagot (1941) concluded that poverty was a vital factor among the causes of delinquency in Liverpool. East *et al.* (1942) found that, of the above-mentioned 496 delinquents aged 16, no less than 142 came from a poor-class district, 26 from a poor and better, 313 from an artisan and only 15 from a superior district. It was found that among delinquents aged 16, the convictions per head increased step by step as the maximum wage increased. It may be noted that the satisfaction or dissatisfaction of a boy with his surroundings depends to some extent upon the standard he expects, and that the same environment may be congenial to some boys and unsatisfactory to others. Individual adaptability as well as habituation may modify dissatisfaction and make an environment acceptable. Miller (1944) states that some of the most startling cases of juvenile delinquency that he has investigated amongst the moderately poor have sprung from satisfactory homes, that

<sup>2</sup> ["In England . . . In modern use . . . large boarding-schools, drawing from the well-to-do classes, pupils who are prepared mainly for the ancient universities or for the public services, and also . . . some large modern schools with similar aims." *The shorter Oxford English dictionary*. Oxford, 2nd ed., 1936.—Ed.]

is to say homes in which there has been no overt disorder or disruption.

Apart from the effect of so-called broken homes, mention may be made of unemployment, failure to join a boys' club, and the influence of associates. It is generally agreed that juvenile delinquency is to some extent an expression of indiscipline, and it is important to consider the quality of the control to which the delinquent has been subjected, as well as his subsequent reaction. East *et al.* (1942) found that of 3,987 offenders aged 16 to 20 in whom a record of control was available there was in each age-group—except for a small number under strict and repressive control—a diminishing amount of resistive action as age advanced.

#### c. Physical Factors

Apart from encephalitis lethargica and certain other diseases, various estimates are given concerning the relation of physical health and juvenile delinquency. Burt (1925) found that defective physical conditions were, roughly speaking, one and a quarter times as frequent among delinquent children as they were among non-delinquent children from the same schools and streets. And he states that regular medical inspection and treatment of all school children, as a matter of routine, has done much to forestall crime and misconduct during later life. Bagot (1941) concluded that his survey did not show inferior health as an important factor in causing delinquency. Pearce (1944) believes that juvenile delinquents lack vigour and robustness. He observes, however, that in many delinquent children the reverse is true and the very quality of their exploits indicates dynamism. The London data of East *et al.* (1942) showed no tendency for the lads to differ in stature from the general population of town dwellers of the same ages. The mean weight of the London delinquents was well below that of London-employed males of similar ages, but was consistently above the general urban industrial average. There was no certain evidence of any association of criminal tendencies and underweight. At age 16, lads with three or more previous convictions registered a statistically significant excess in the mean chest measurement over lads with fewer convictions. The fact that physical inferiority is sometimes related to marked social achievement is generally recognized. There is often, of course, no association between the physical disease of an offender and his offence.

#### d. Mental and Moral Factors

The causal relation of mental defect and juvenile delinquency has been variously estimated. In his early researches Burt found 8 per cent of his delinquent children were definitely

defective. Lewis (1944) emphasizes the fact that it is impossible to estimate even approximately the number of mentally defective persons in the certified institutions in Great Britain who were potential criminals and who would, sooner or later, have appeared in the courts had they remained in the general community. Bagot (1941) concluded that backwardness is strongly associated with delinquency. East *et al.* (1942) found that among the London delinquents the proportion who were mentally defective (5 per cent) was very much higher than would be expected in a random sample of the general population. Miller (1944) states that most observers agree that intelligence-level is a factor in the retention of normal standards of social behaviour but does not alone occasion delinquency. Of the 496 London delinquents aged 16, only 4 were found to be suffering from insanity, 3 from epilepsy and 2 from psychoneurotic disorder. Emotional and temperamental disabilities, however, are frequently associated with juvenile delinquency.

Except for a few cases of moral defectiveness (i.e., ethically aberrant psychopathic personalities) many of the so-called moral deviations of behaviour associated with delinquency can be only loosely defined. Excluding examples of psychopathology, some are attributable to parental carelessness, and may be the result of parental disregard for the rights of others, or of a more expressed determination to leave correction to the teacher when the child goes to school. Any discussion on the increase in juvenile delinquency today must differentiate between naughtiness and the more serious forms of delinquency. The latter can hardly be avoided if the delinquent's associates approve of his misbehaviour, and if the general moral standards of modern adults remain at their present low level. However this may be, as with the body so with the mind: scarlet fever may select only one member of the family, and delinquency may be due to causes which leave others in the family unscathed. The many contradictory conclusions of experienced observers leave one in no doubt that every juvenile delinquent presents a special diagnostic, prognostic and therapeutic problem, and that causal factors may reinforce or cancel out each other.

### 3. Treatment

Reference has been made to the broad methods adopted by juvenile courts when dealing with delinquency. Medical psychologists aided by trained social workers have a contribution to make in a proportion of exceptional cases. An immediate requirement seems to lie in greater preventive efforts. This may follow if the world's present moral apathy is superseded and genuine citizenship becomes an important educational study.

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# MENTAL ASPECTS OF SENESCENCE

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- 1 The general problem
  - 2 Senile deterioration
  - 3 Survey of psychological work
  - 4 Symptomatology of deterioration
  - 5 Etiological considerations
  - 6 Therapeutic considerations
  - 7 Present trends of research
- References

## 1. The General Problem

According to the estimate of the Registrar-General, persons over the age of 65 will in 1951 form 11·6 per cent, and by 1971, 17 per cent of the population of England and Wales, unless there is a change in the present trends of birth and mortality rates. It is therefore not surprising to find that in recent years increasing attention has been paid to the social and medical care of the aged, and an extensive study was undertaken for the Nuffield Foundation by a Survey Committee on the Problems of Ageing and the Care of Old People under the chairmanship of Mr. B. Seebohm Rowntree. The report of this Rowntree Committee was published under the title *Old people* (Rowntree, 1947), and the social and medical issues raised have stimulated considerable public interest.

Further to this study, Sheldon (1948) carried out a medical survey in Wolverhampton, an English Midland town with a population of about 150,000, on one of the random samples of men over 65 and women over 60 which had been investigated from a social angle by the Rowntree Committee. Information was collected from 477 people during personal visits, and supplemented in many cases by the opinions of friends and medical attendants. The wealth of data obtained was analyzed under the three headings of "Physical state," "Mental state," and "Domestic structure," but the interdependence of all findings in determining the status of health of the individual emerged clearly. To give only one instance: deafness and vertigo due to degenerative disorder of the internal ear were frequently found to produce disorientation in the dark, sometimes precipitating nocturnal confusional episodes.

Turning to the mental state of old people living at home, the picture is, on the whole, a cheering one for the reader accustomed to dealing with patients suffering from senile deterioration in mental observation wards and hospitals. Only 3·8 per cent of the persons visited presented evidence of mental breakdown; 11·2 per cent showed slight impairment of their mental faculties; 3·2 per cent were eccentric in their habits, without suffering from intellectual deterioration; the remaining 81·8 per cent were classed as fully normal mentally. Moreover, a fair proportion of these old

folk left a distinct impression on the investigator's mind of unusually fine and vigorous characters. It is reassuring to have confirmation, scientifically obtained, of the impression gained in everyday contact with old people, that the overwhelming majority retain their mental faculties to the full.

On the other hand, Aubrey Lewis (1946) pointed out that the statistics of the Board of Control (England and Wales) showed that the annual number of 'first attack admissions' of patients over the age of 65 in the years 1907 and 1937 increased from 821 to 1,187 for males, and from 897 to 1,522 for females. An analysis of the incidence rates per 100,000 of the population over 65 gave anomalously low values, especially when compared with figures in the USA, which show steep increases of 'first admission rates' with rising age. Lewis presented convincing evidence to show that the comparatively low incidence rates of first admissions of patients over 65 in this country were due to the retention in public assistance institutions of many patients who should have been admitted to a mental hospital. Moreover, in the area of the London County Council (1947) accommodation has been provided for cases of senile dementia at the Tooting Bec Hospital. To this institution, with nearly 2,500 beds, elderly patients with mental disorders have been admitted either under a section of the Lunacy Act of 1890 which deals with the detention of harmless persons of unsound mind in workhouses, or, if they are over 70 years of age and with no record of previous certification, without formalities under the Lunacy Acts.

A more limited study was undertaken in Scotland by the present writer (Post, 1944), who analyzed the admission figures of the Royal Edinburgh Hospital for Mental and Nervous Disorders and found that the proportion of patients admitted over the age of 60 had steadily risen from 14·35 per cent (14·3 % males, 14·4 % females) in 1903 to 30·9 per cent (27·9 % males, 33·0 % females) in 1942. When these trends are viewed in conjunction with the estimated future increase in the number of old people, we are forced to agree with the conclusion that "We must regard the mental disorders of the elderly as likely to be responsible within the next thirty years for the bulk of the patients admitted to mental hospitals." (Lewis, 1946)

## 2. Senile Deterioration

There are few psychiatric disorders which may not occur, either as a recurrence or for the first time, during senescence. Especially, first attacks of a manic-depressive psychosis in an episodic or chronic form are not at all uncommon, and convulsive therapy has been employed to an increasing extent in aged patients (Mayer-Gross, 1945). The so-called presenile dementias, though by definition beginning before the onset of senescence, frequently manifest themselves after the age of 60. Contributions to the symptomatology of these disorders (Stengel, 1943) and their relationship to senile dementia (Newton, 1948) have recently been made in Great Britain. In the present survey, we shall concern ourselves only with the much more common mental disorders due to senile and arteriosclerotic brain changes. Moreover, it is not possible to give a full account of all the aspects of deterioration from normal senescence; it is merely intended to give some information on the trend of work done recently in Britain.

### 3. Survey of Psychological Work

Psychological studies of ageing and senility were reviewed and critically examined by Margaret Davies Eysenck (1946), who concluded that the studies undertaken so far have been largely exploratory, and pointed out the fallacy of drawing conclusions on the mechanism of the psychology of ageing from the comparison of groups of young people with groups of old people; she advocated "large-scale longitudinal follow-up studies" designed to reveal the intellectual, emotional, temperamental and attitudinal changes occurring during an individual's life.

Her own contribution (Eysenck, 1945) has been an exploratory study of mental organization in senility, in which she applied factorial analysis to the results of 20 psychological tests given to 84 co-operative patients with senile dementia. Re-test reliabilities were established for the tests used, and three group factors concerned with speed, memory, and physical strength, respectively, as well as a general factor, emerged. This general factor presented a picture of mental organization which differed greatly from that found in normal adults and was thought to be due to the differential deterioration in senile patients of what Cattell called "fluid" and "crystallized" abilities. This point was illustrated particularly clearly by the finding that whereas seniles scored considerably above the 14-year-old level on the Mill Hill Vocabulary Test (a test representative for "crystallized" ability), only the 8-year-old level was reached on Raven's Progressive Matrices Test, which is a highly representative test for "fluid" abilities.

These two tests were used by Foulds & Raven (1948) in an attempt to draw inferences concerning normal changes in mental ability for ages up to 60. Broadly speaking their results were "... in agreement with the generally accepted view that from about the age of 30 onwards a person's ability to understand new methods of thinking, adopt new methods of working, and even to adjust to new situations, steadily decreases, whereas he is normally able to recall acquired information long after his capacity to adapt to new situations has begun to decline." The authors stress the need of information concerning the normal changes after the age of 60.

### 4. Symptomatology of Deterioration

Mildly deteriorated senile patients are more often encountered by the general practitioner than by the psychiatrist. Sheldon (1948) examined the symptomatology of men and women with a mild impairment of mental faculties who made up 11.2 per cent of his random sample of old people living at home. He summarized his observations in giving as early signs of senile mental failure: "Some restriction of activity, with a tendency to apathy; a mild disturbance of appetite; a definite liability to change of mood, especially apt to express itself by depression of spirits; a slight failure of memory; a tendency to aberration of talk—either in the direction of loquacity and rambling speech or in a slowness of speech; a tendency to morbid anxiety, and a diminished desire for occupation and capacity for self-care."

It is at this stage of mild senile deterioration that asocial behaviour disorders may emerge for the first time in a person's life. Though Norwood East (1944) draws attention

to "... the well-known fact that the incidence of crime per 100,000 of the population of the age or age groups consistently decreases after thirteen as age advances", he quotes Goring's (1919) analysis of the age incidence of 682 first offenders convicted of serious offences as demonstrating that between the ages of 60 and 65 there is a transient period of exacerbation in an otherwise rapidly diminishing tendency towards crime. Certain types of offence such as homosexual acts with boys and attempts at suicide were relatively more frequent in persons over 60 than in younger age-groups, and East (1944) states that "... clinical experience suggests that in many cases as one gets older personality seems to be a more important crimino-genic factor than environment. In young and middle-aged persons a first offence is only occasionally an early indication of mental abnormality; in elderly persons it should at once arouse doubts as to whether it is the result of senile degeneration." The difficulties which are encountered in medico-legal practice in determining criminal responsibility of aged offenders are discussed fully, and East expresses the opinion that a knowledge of the mental background of such a person may suggest the most suitable way of dealing with him, and of protecting society from his misconduct<sup>1</sup>.

In Sheldon's (1948) sample of old people living in their own homes 3.8 per cent suffered from severe mental deterioration, and several of the subjects in this group had to be admitted to mental hospital in the course of the investigation. Post (1944) found that by far the commonest immediate cause for hospital admission was a confusional state, apparently acute in onset; in addition, deterioration of personal habits made transfer to a mental hospital necessary much more frequently than did paranoid, aggressive, or suicidal tendencies. Using Rothschild's (1941) criteria for the clinical differentiation of senile and arteriosclerotic psychoses, it was possible to show how much more favourable was the immediate prognosis—in terms of discharge from hospital—in arteriosclerotic as compared with senile cases. Review of the histories and clinical states suggested that patients broadly fell into two groups: in one, a simple dementia, either on a senile or an arteriosclerotic basis, developed in an inconspicuous fashion, whereas in the other group florid psychotic symptoms, often bizarrely paranoid or depressive in type, dominated the picture until a more profound stage of dementia supervened.

### 5. Etiological Considerations

In agreement with earlier work, it has been found that a large proportion of people developing senile or arteriosclerotic deterioration had been ill adjusted psychologically all their life. Lewis & Goldschmidt (1943) discovered well-marked personality difficulties in 67 per cent of their Tooting Bec cases, while Post (1944) gives a figure of 62 per cent; the latter was also able to confirm that patients who exhibited positive psychotic symptoms as well as dementia had, on the whole, been far more seriously maladjusted throughout life than those suffering from a simple dementia only. The importance of the constitutional factor is further supported by evidence of the familial incidence of the disorders under discussion. Confirming the findings of Meggendorfer

<sup>1</sup> [The care of the mentally defective criminal is discussed by Sir Norwood East in this number of *British Medical Bulletin* (BMB 1304).—Ed.]

(1926) and Weinberger (1926), 25 of Post's 78 cases (32.1 per cent) of senile or arteriosclerotic mental disease had a positive psychiatric family history; in 15.4 per cent this was one of senile or arteriosclerotic deterioration, and if relatives who had suffered from strokes, allegedly without psychiatric complications, were included, the figure for positive family history rose to 24.4 per cent (Post, 1944).

The main practical question which the study of the mental aspects of senescence throws up is, whether there is anything we can do to prevent or retard the onset of senility. Recognition of the importance of constitutional factors such as heredity and personality-structure may help to indicate the type of person on the danger list for mental deterioration; but if these considerations are allowed to influence our therapeutic attitude unduly, they may be as harmful as is preoccupation with brain damage to the exclusion of the dynamic aspects of personality. Leaving aside as self-evident the importance of maintaining general health and of attending to special physical defects, etiological factors operating from the environment would appear to be the only ones which can be removed or modified.

Sheldon (1948) was able to compare the social circumstances of normal aged persons with those of people showing slight mental impairment (11 per cent of his sample). The members of this group, demonstrating as it were senility *in statu nascendi*, were relatively more afflicted with the burdens of the widowed state, loneliness and domestic anxiety than normal old folk. A feeling of loneliness, in particular, was definitely associated with a mild degree of mental impairment and in a large majority of cases was due to recent loss of the marital partner. On the other hand, a considerable proportion of the subjects who felt lonely were not in fact living alone, and Sheldon considered the question as to how far anxiety and a sense of loneliness were symptoms, rather than causes, of mental impairment. He came to the tentative conclusion, however, that some individuals are so constituted in their personality as to be more prone to feelings of loneliness and anxiety than others, and that they will react more deeply to an unfavourable social environment; the resulting upset of emotional balance might then initiate a train of deterioration of personality and intellect. In the senile dementia patients studied, after their admission to hospital, by Lewis & Goldschmidt (1943), failure to retain a place in the community, to remain a member of a family, or to have an appreciated share in the life of some household or working group, was a common finding. This defect of social integration was looked upon as powerfully adverse to mental health; although in some of the cases it had been the outcome of a wayward and difficult personality, the authors thought that in many, the breaking down of social integration had been the unavoidable consequence of the narrowed circle, bereavements, and an incapacity for forming new habits and associations.

## 6. Therapeutic Considerations

All branches of medicine must make their contribution towards the maintenance of health during old age. The psychiatric approach is determined by an endeavour to postpone or mitigate the effects of brain changes on personality functions or, in other words, to influence the rate and extent to which senescence changes into senility. In

the psychiatric care of the ageing patient attention is paid to the emotional state, and attempts may be made to modify attitudes and neurotic tendencies which may have existed for many years but whose exacerbation is frequently a danger-signal of impending senile deterioration. Though in selected cases this approach may be very helpful, an attempt to influence etiological factors in the environment of the ageing person is usually more feasible. The feeling of loneliness can often be combated by interpreting the patient's behaviour to his friends and by encouraging them to allow him or her to take a more active part in the family circle. The psychiatric social worker will, in addition to her work with the patient's family, help him towards the cultivation of hobbies and put him in touch with one of the increasing number of clubs for old people. Beyond outlining these general principles, no further elaboration of the practical approach will be attempted, because basically the problem is too large to be solved in terms of treatment of the individual patient. In the discussion, at the 1948 Annual Conference of the British Medical Association, on the early recognition and treatment of senile deterioration, all the speakers stressed the paramount need for re-orientation of our social attitude towards the aged; instead of being obliged to retire at a fixed age, old people should be retained as long as possible in carefully selected and reasonably gainful employment. Earlier Mackintosh (1947) had even gone so far as to suggest the introduction of selection boards and the application of the methods of child guidance in old age.

## 7. Present Trends of Research

A serious decline in the standard of living in Great Britain would, in fact, inevitably result from the increase in the number of old age pensioners and the simultaneous decrease in the size of the working population, which have been predicted by the vital statisticians. One way of keeping national production and income at the present level might be by raising the retiring age and thus retaining elderly people in productive employment.

At the Nuffield Research Unit into the Problems of Ageing, which is under the direction of Sir Frederic Bartlett at Cambridge, investigations are in progress on the issues involved in maintaining the efficiency of men in later middle age employed in industry, and the work of the Unit has been concerned mainly with the timing and detailed analysis of some skilled operations, both motor and mental; special attention is being paid to the investigation of problems of re-training. At the Department of Psychological Research of the Crichton Royal, the mental hospital at Dumfries, J. C. Raven has been able to standardize the Progressive Matrices and Mill Hill Vocabulary Tests for British people of all ages up to 65, and enquiries are in hand concerning normal and abnormal changes after that age.<sup>2</sup> On the clinical side it is hoped to establish a geriatric unit at the Bethlem Royal Hospital, Beckenham, and the Maudsley Hospital, London, where problems of early deterioration will be studied from psychiatric, psychological, and social angles. Thus work is proceeding along fresh lines of approach which in time should lead to an increasing understanding of the mental aspects of senescence.

<sup>2</sup> Personal communications



## STUDY AND TREATMENT OF THE CRIMINAL, AND CARE OF THE MENTALLY DEFECTIVE AND MENTALLY ABNORMAL CRIMINAL

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### A. PROVISIONS FOR THE STUDY AND TREATMENT OF THE CRIMINAL

Since the beginning of the present century psychological and psychiatric studies in Great Britain have added valuable information towards a better understanding of the criminal, and of the many problems involved in the prevention and treatment of crime. Modern sociological and penological investigations also have advanced our knowledge. But no single line of approach can do more than provide the investigator with some of the clues necessary for an understanding of the subject.

Studies have been carried out by, or with the consent of, Government departments, civil and military; by societies and other bodies; and by individuals. Sometimes investigations inaugurated for another purpose throw light upon

the causation and prevention of criminal behaviour. Finally, the Executive Authority is constantly assessing the value of new proposals and ideas with a view to incorporating into the administrative machine such as may prove practical and progressive.

#### 1. Official Studies

The Prison Commissioners frequently explore new methods in the training, education, rehabilitation and after-care of prisoners. A detailed account of the progress made is published yearly by His Majesty's Stationery Office (His Majesty's Prison Commissioners Annual Reports). Other studies have been carried out by teams and individuals. For example, in 1933 the Home Office, with the co-operation of fifteen Magistrates' Courts, began an enquiry with the object of ascertaining how many offenders placed on probation commit further indictable offences during a period of three years after the probation is ended. In the same year another investigation examined the files in the Criminal Record Office of 20,667 persons over the age of sixteen found guilty of offences sufficiently serious to warrant the taking of finger prints, and who had no previous offences recorded against them, in order to estimate the proportion who were free from further charges during the subsequent five years. The work has been continued and the latest published results refer to 139,862 offenders (Report of the Commissioners of Prisons, 1947).

Before 1933 a medical psychologist (Pailthorpe, 1932) issued a report on studies in the psychology of delinquency. The work was carried out under the auspices of the Medical Research Council with the co-operation of the Home Office.

Team work by Prison Medical Officers, lasting in some cases for several years, enabled an anthropological survey of the English convict to be published (Goring, 1913). A report on the psychological treatment of crime appeared in 1939 (East & Hubert, 1939), and a statistical study of 4,000 adolescent criminals in 1943 (East, Stocks & Young, 1943). Individual medical officers have published books on the subject of crime and criminals, and have written numerous papers for the scientific journals.

The Second World War enabled psychiatrists attached to the fighting Services to study large groups of men who became mentally disturbed by employment as combatants. Many of the disturbances presented themselves as problems in delinquency. Early in 1942 the Navy opened Kielder Camp as an observation and treatment centre for mentally abnormal ratings, some of whom were delinquents. Many interesting papers by Service psychiatrists on different aspects of the association between combatant service and

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criminal behaviour have appeared in the medical journals. Negative studies also have been significant. For example, the medical officers of a submarine flotilla collected material which tended to show that the submarine service attracted a stable type of man who maintained a high state of morale and that psychiatric illness in its personnel was very small.

## 2. Studies by Societies

The Medico-Legal Society frequently, and other societies occasionally, discuss at their regular meetings problems concerning criminals and the prevention and treatment of crime. Lectures on forensic psychiatry have been given for many years at the Maudsley Hospital Medical School (now the Institute of Psychiatry, University of London) in connexion with the postgraduate course for the Diploma in Psychological Medicine (D.P.M.). Lectures on criminology are also now given in the Institute of Psychiatry at the Maudsley Hospital, and postgraduate students on the clinical staff of the hospital receive as part of their normal training opportunities of studying the forensic aspect of psychiatry at certain London prisons.

The Howard League for Penal Reform has long studied criminals and their treatment, and in its journal reviews modern methods for the prevention of crime and delinquency. Recently an International Committee of the Howard League for Penal Reform (1947) published in book form a policy which it is suggested should be applied to the Juvenile Courts. The Tavistock Clinic and the Institute for the Scientific Treatment of Delinquency, as well as other psychiatric clinics, have developed researches which include the diagnostic and therapeutic approaches to delinquency.

## 3. Studies by Individuals

Psychiatrists attached to mental hospitals, having special opportunities for study, contribute to the scientific journals papers which discuss certain aspects of the problem of the association of mental disease or defect and criminal behaviour. In recent years magistrates and others, sometimes aided by the generosity of the trustees of endowed funds, have published the results of individual research. And although some of the writings fail to avoid a biased presentation, many provide a stimulus to those whose minds are progressive and imbued with the importance of crime as a social problem.

## 4. Extraneous Studies

In 1934 the Carnegie United Kingdom Trustees published a report (Bell, 1934) on the Junior Instruction Centres which were established to prevent deterioration or demoralization likely to arise from unemployment. Amongst other matters the investigation considered whether the Centres had helped to counteract the increasing amount of juvenile crime. In 1943 the Hygienic Committee of the Women's Group in Public Welfare issued a report dealing with an investigation into the domestic habits and customs of certain town dwellers evacuated during the war. The report showed a broad, humane and factual approach to many matters; from it emerged further reason to believe that juvenile delinquency appeared to be, at least in part, another of the problems due to parental failure. A report (Stephens,

1945) issued by the Pacifist Service Units on an experiment in the social rehabilitation of problem families stated that, in a certain group of cases investigated, mental and psychological difficulties were invariably found, and that psychiatric treatment proved ineffective mainly because of the absence of a satisfactory home background. It was also found that the instability of many patients rendered continuous treatment impossible.

The Burden Neurological Institute, in association with the Society for the Study of Addiction (to Alcohol and Drugs), and aided by a grant from a body of interested persons, is conducting research into the nature and causation of alcohol addiction; the findings may influence the treatment of the alcoholic offender.

The catholicity of the studies in progress is made apparent by the fact that eugenic research and the experience of Marriage Guidance Councils provide relevant information. The Civil Courts add their quota. A distinguished County Court Judge has recently stated (Earengy, 1948) that in tenement dwelling-houses parental influence decreases to the vanishing-point, and that he is convinced that much of the looseness of behaviour tending to immorality and crime in (but by no means confined to) the classes brought up in tenements is substantially due to bad housing conditions.

## 5. Studies by the Executive Authority

These are concerned with the trend of modern thought in the prevention of crime and the treatment of the criminal, and relevant matters are periodically reviewed by the Home Office Advisory Council on the Treatment of Offenders.

## B. PROVISIONS FOR THE CARE AND TREATMENT OF MENTALLY DEFECTIVE AND MENTALLY ABNORMAL CRIMINALS

### 6. Mentally Defective Persons

The Mental Deficiency Act, 1913 gave Criminal Courts power to take steps to place a mentally defective offender under guardianship, or cause him to be detained in an institution for defectives. It also authorized the Home Secretary to transfer to an institution for mentally defective persons a prisoner undergoing a prison sentence if he is satisfied, on the certificate of two medical men, that the prisoner is mentally defective.

Institutions for mentally defective persons are of two kinds: *State institutions* are established and maintained by the Board of Control<sup>1</sup> for defectives of dangerous or violent propensities; *Certified institutions* are institutions in respect of which a certificate has been granted under the Act to their managers to receive defectives.

### 7. Insane Persons

If they are so insane as to be unfit to plead, insane offenders are detained in a mental hospital. An offender who is found to be guilty but insane is also similarly detained. A prisoner who is found to be insane during a prison sentence is certified as such by two doctors and two visiting Justices,

<sup>1</sup> [The Board of Control was created by the Mental Deficiency Act of 1913. As from July 1947, the administrative functions of the Board of Control were transferred to the Minister of Health, the Mental Health Service thus being integrated with the National Health Service.]

An article on mental health and the National Health Service is to appear in the next number of the Bulletin.—Ed.]

## THE LAW RELATING TO TEMPORARY TREATMENT IN MENTAL HOSPITALS

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- 1 Provisions and safeguards of the 1930 Act
- 2 Difficulties in interpretation
- 3 Statistical data
- 4 Procedure in Southern Rhodesia and Northern Ireland
- 5 Possible changes in the 1930 Act

Temporary treatment is the procedure by which patients who have no volition, that is to say who are incapable of expressing themselves as willing or unwilling to receive treatment, may be detained for a limited time without certification as persons of unsound mind. This procedure is not followed in Scotland, but applies to England and Wales only.

Before the passing of the Mental Treatment Act, 1930, a poor person resident in England or Wales could not, in general, receive treatment for mental illness until he had

been certified as of unsound mind and sent to a mental hospital under a reception order made by a justice. The main purpose of the Act of 1930 was to remedy this state of affairs and to give effect to the recommendation of the Royal Commission which, when reporting in 1926, had urged that certification should be the last resort and not the necessary preliminary to treatment. Accordingly the Act not only enabled local authorities to make provision for out-patient and voluntary in-patient treatment for poor persons but also, by section 5, required them to take such steps as they considered necessary to provide and maintain suitable accommodation for the reception of temporary patients.

### 1. Provisions and Safeguards of the 1930 Act

Treatment under the provisions of section 5 is obtainable on written application made, if possible, by the husband or wife, or by a relative of the person to whom it relates, accompanied by a recommendation signed by two doctors, of whom one should, if practicable, be the usual medical attendant of the patient, and the other a doctor approved for the purpose of making recommendations under the section by the Minister of Health. Treatment is limited, in the first instance, to six months, but if it is anticipated that the patient will not recover within the period of six months, though his early recovery thereafter appears reasonably probable, it may be extended on application duly made not more than one month nor less than 14 days before the expiration of the current period of treatment, for further periods of such lengths not exceeding three months as may be directed by the Board of Control, provided that such further periods shall not exceed six months in all.

In order to safeguard the patient against improper

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and the Home Secretary has power to transfer the prisoner to a mental hospital. The most serious cases are usually detained in the State Mental Hospital at Broadmoor, Berkshire.

#### 8. Minor Forms of Mental Abnormality

A part of certain prisons is used as an observation and treatment centre for prisoners who are suffering from lesser forms of mental abnormality, and psychotherapists are engaged to treat cases susceptible to this form of treatment. If modern methods of diagnosis and treatment are not available the prisoner can be sent to a mental hospital or clinic for the purpose. The Prison Commissioners have accepted the principle of establishing on colony lines a special institution under their administration for this class of offender. But difficulties due to the Second World War have delayed its inception.

Offenders suffering from mental abnormality are frequently remanded to prison for medical examination and report. The Criminal Justice Act 1948 empowers the Court also to remand an offender on bail for a first period of three weeks, to enable a

medical examination and report to be made. A person remanded on bail may be received for this purpose into an institution within the meaning of the Mental Treatment Act 1930 (i.e., a mental hospital or other premises maintained by a Local Authority for the purposes of this Act), a registered hospital or licensed house, or into an institution for mentally defective persons within the meanings of the Mental Deficiency Acts.

When the court is satisfied on expert medical evidence that the mental condition of the offender requires and may be susceptible to treatment, but is not such as to justify his being certified as a person of unsound mind under the Lunacy Act 1890, or as a defective under the Mental Deficiency Act 1913, the Criminal Justice Act allows a court to add to a probation order a requirement that the offender shall undergo medical treatment for a period not extending beyond twelve months, with a view to the improvement of the offender's mental condition. It is believed that such treatment, if commenced early in an offender's career, may have lasting benefit and tend to reduce the amount of crime committed by mentally abnormal persons.

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reception or detention the section provides for him being visited within one month of his reception by two members of the hospital management committee and that, if he becomes capable of expressing himself as willing or unwilling to receive treatment, he shall not thereafter be detained for more than 28 days unless in the meantime he has again become incapable of expressing himself. Power to discharge is vested in the same persons and bodies as in the case of a certified patient with the added safeguard that the Board of Control may at any time order that the patient shall be discharged or that steps shall be taken to obtain a reception order for his detention as a person of unsound mind.

## 2. Difficulties in Interpretation

Section 5 was designed to provide treatment for the confusional type of case, of which it was estimated that there was a considerable number, and in particular for puerperal cases, many of whom fall within its scope. It appears to have been thought that continuance of treatment would readily be secured by regrading patients as voluntary patients if they recovered volition during their period of temporary treatment. From the outset, however, difficulty arose as to the interpretation of subsection (12), which provides that

if a person who has been received as a temporary patient becomes capable of expressing himself as willing or unwilling to receive treatment he shall not thereafter be detained for more than twenty-eight days unless in the meantime he has again become incapable of so expressing himself.

Doctors were naturally prone to regard the words "capable of expressing himself" as indicating the expression of a rational wish which was in conformity with the interests of the patient. That such an interpretation was not the intention of Parliament was clear from a passage from the speech of the Government spokesman during the debate in the House of Lords which ran as follows:

No attempt should be made to construe 'volition' as meaning rational volition. Therefore even if the wish is irrational or is contrary to the best interests of the patient, if he expresses willingness or unwillingness he cannot properly be regarded as without volition.

This interpretation of subsection (12), which the Board of Control felt bound to give effect to, imposed serious burdens not only upon medical superintendents in relation to treatment but also raised difficult problems for the bodies and persons charged with the statutory visitation of temporary patients, within one month of their reception, under subsection (9). As regards the latter it meant, in strictness, that if upon visitation the patient, however confused he might be, expressed a wish to go home, the statutory visitor was under a duty to report to the Board of Control that it was not proper that he should continue to be detained under care and treatment. As a result of these difficulties the section soon came to be regarded by many medical superintendents as unsatisfactory and too complicated to be worthy of operation.

## 3. Statistical Data

Reviewing the position in their report for 1935 the Board of Control stated that, whereas the number of temporary patients admitted to public mental hospitals in 1931 represented 1.8 per cent of the total direct admissions, that figure had by 1935, as a result of special efforts made by the Board

and by Local Authorities, risen to 5.2 per cent; they commented on the fact that this latter figure was little more than half the proportion of temporary admissions to private institutions and expressed the view that experience over the five years since the coming into operation of the Act confirmed the estimate of its framers that the proportion of admissions falling within the scope of the section was not likely to exceed 15 per cent. It appears from a study of the relevant section of the Board's 1935 Report that even at that date they were of opinion that some simplification of the provisions of the section was indicated as soon as a favourable opportunity occurred, and that this might take the form of a modification of the twenty-eight-days rule, which necessitates regrading and fresh formalities if the patient's condition changes and there is a return of volition.

The figure of 5.2 per cent recorded in the Board of Control's report for 1935 was exceeded only in two subsequent years, namely in 1936 when it was 5.3 per cent and in 1938, in which year it rose to 5.5 per cent. From 1938 to 1946 it hovered around 4 per cent but the figure for 1947 descended to 3.5 per cent. It seems significant also that the corresponding figure for temporary admissions to private institutions and single care (types of care catering for the wealthier sections of the community) have fallen from 8.5 per cent in 1935 to 2.9 per cent in 1947. Incidentally, it may be of interest to record here that, in relation to the total direct admissions to public mental hospitals, the percentage of certified patients, which in 1931 stood at 91.1 per cent, had by the end of 1947 decreased to 42 per cent, while the corresponding percentage of voluntary admissions to such hospitals in 1947 attained a new high average at 54.5 per cent.

It seems clear from the figures quoted above, that the existing provisions for temporary treatment, contained in section 5, have been found so complicated and difficult of operation that they have had a deterrent effect upon those who contemplated availing themselves of them. Drastic alteration seems necessary both as regards the provision relating to initial reception as a temporary patient and in order to do away with the twenty-eight-days rule, which necessitates regrading and fresh formalities on return of volition. What form should the alteration take?

## 4. Procedure in Southern Rhodesia and Northern Ireland

The provisions of section 5 have been reproduced, with or without modification in detail, in various Dominion and Colonial enactments, and the relevant provisions of two of these, the Southern Rhodesian (Mental Disorders) Act, 1936, and the Mental Health Act (Northern Ireland), 1948, appear to be worthy of consideration.

*Southern Rhodesia.*—Sections 44 to 46 of the Southern Rhodesian Act afford temporary treatment, without the intervention of a judicial authority, to

a person who is suffering from mental disorder (whether he is or is not capable of expressing volition) and is likely to benefit by temporary treatment, but is also unfit on account of his mental state to be received and maintained as a voluntary patient.

The provisions relating to applications for treatment, visitation after reception, period of treatment and discharge, follow closely the wording of the English Mental Treatment Act except that the person who made the original application may, at any time, order the patient's discharge. Section 74

also provides a general safeguard enabling the patient to call the Courts to his aid.

The effect of these sections seems to be to provide for temporary treatment of resistive as well as of non-volitional patients; thus patients who, though volitional in the sense that they express refusal of treatment, are, in the judgement of the two doctors making the recommendation, without insight into their mental condition and unaware of their need for treatment, can be detained for a period not exceeding, with any extensions granted by the prescribed Authority, 12 months in all.

There is much to be said in favour of these provisions which, it will be observed, abolish the (twenty-eight-days) rule in the English Act requiring the regrading of the patient as a voluntary patient within 28 days after recovery of volition, and enable the doctor in charge of the patient either to continue to detain the patient for the current period of treatment if he is not satisfied that recovery of volition is likely to be permanent or, if at any time during the current period he believes that recovery of volition is likely to be permanent, to regrade the patient on a voluntary basis. A further advantage, from the medical point of view, is that by affording temporary treatment to resistive patients whose refusal of treatment is due to lack of insight into their mental condition, the Rhodesian Act recognizes such refusal and also any protests during treatment as irrational, and permits treatment to be continued unhindered.

*Northern Ireland.*—The provisions of the Northern Ireland Act are somewhat revolutionary, their effect being that persons admitted to mental hospitals will be in two groups only. The first group consists of voluntary patients who appreciate their need for treatment and apply to obtain it, the second group of temporary patients.

Section 7 of this Act makes provision for the reception into a mental hospital, on a written application duly made in accordance with the provisions of the section, of a person who is suffering from mental illness and is unfit on account of his mental state to be received (or to continue) as a voluntary patient, or of a person who is an addict, as a temporary patient. The application must be accompanied by a recommendation in the prescribed form signed by a duly qualified medical practitioner and specifying the grounds on which he bases his recommendation. Treatment in the temporary category is for an initial period of one year which may from time to time be extended for further periods of such length, not exceeding six months, as may be specified in directions given by the Ministry of Health and Local Government, provided, however, that the total period of treatment as a temporary patient shall not in any case exceed two years from the date of the patient's first admission as such. When, however, the patient is, at the completion of the two years, undergoing special treatment and the Ministry

is satisfied that the patient's recovery is probable on the completion of that special treatment, the Ministry may authorize an extension of the period of special treatment beyond the two years for the purpose of the completion of the special treatment. Section 9 provides that when it is no longer proper to retain a mentally ill person as a temporary patient steps may be taken to have him certified, by a judicial authority, as a person of unsound mind.

Subsection (3) of section 6 of the same Act makes provision for the taking of steps to deal with a voluntary patient as a temporary patient if the medical superintendent is satisfied that the patient is, by reason of a change in his mental state, unable to appreciate his status as a voluntary patient and has remained in that condition for a period of 28 days.

### 5. Possible Changes in the 1930 Act

The scheme of the Northern Ireland Act attains in full measure the objective put forward by the Royal Commission that certification should be the last resort and not the necessary preliminary to treatment and, in that respect, its provisions are most attractive. The British Parliament, however, has always been assiduous to preserve the liberty of the subject and to provide strong safeguards when mentally ill persons are detained. Would it look with favour upon, firstly, the signing of a recommendation for temporary treatment by only *one* medical practitioner (who need not apparently be specially qualified in the diagnosis and treatment of mental disorders), and secondly, the fixing of the initial period of temporary treatment at *one year* with further six-monthly extensions to a full period of two years?

As regards the first question, the Board of Control has always taken the view that there is no legal objection to the second signatory of the existing form of recommendation (who must be a registered medical practitioner approved by the Minister of Health for the purpose of making recommendations under section 5) being a senior medical officer of the hospital into which the patient is to be received. If the second signatory is either such a medical officer or a consultant whose services are available free of charge under the National Health Act, 1946, the requirement that the recommendation must be signed by two doctors should not present difficulty either upon the ground of expense or otherwise. It seems possible, therefore, that Parliament may think it desirable to preserve the existing requirement that the recommendation shall be signed by two doctors.

As regards the total period of temporary treatment to be permitted, perhaps an extension to eighteen months in all would afford a reasonable compromise between medical and legal views.

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## Shorter Notices

Bronconeumonectasias congénitas—L'aphasie et la désintégration fonctionnelle du langage—Psychotherapy—Exercises for certain diseases of heart and lungs—Science and nutrition—Enuresis or bed-wetting—A pocket medicine—Injertos de piel—Recent advances in obstetrics and gynaecology—Text-book of pathology—Ways to better hearing—Sizes of X-ray film and intensifying screens—The distressed mind—British surgical practice—Social history of school meals service—Practical section cutting and staining—Dietetics in general practice—Blindness in British African and Middle East territories—Textbook of medicine—Chest diseases—L'exploration fonctionnelle des reins—Biological standardisation of vitamins—Pregnancy diagnosis tests—Psychological medicine—Chirurgie de la surdit  (l'op ration de Lempert)—Practice of industrial medicine—Diphtheria—Prescribing and fitting of contact lenses—O tratamento cir rgico da hipertens o do sistema porta por anastomose venosa direta—Obstetrics and gynaecology—Manual of obstetrics—Mental health—Otitis media en el lactante—Pharmacology—Queen Charlotte's text-book of obstetrics—Estudios sobre la coca y la coca na en el Peru—Recent advances in pathology—Materia medica—Practical histology for medical students—Study of hospital administration—Practice of mental nursing—Short textbook of surgery—British hospitals—Truby King—The Scotsman's food—La streptomycine et ses applications th rapeutiques—Minor surgery—Personality projection in the drawing of the human figure—Handbook of practical bacteriology—El ingl s para m dicos y estudiantes de medicina—History of State medicine in England—Textbook for almoners—Practical food inspection: fish, poultry and other foods—Textbook of surgery for dental students—Rehabilitation and resettlement of disabled persons—Report of Departmental Committee on Industrial Diseases—Control of health hazards from radioactive materials—Textbook of anaesthetics—Clinical examination of the nervous system—The doctor and the difficult child; The doctor and the difficult adult—Manual of leprosy—Genetics, medicine, and man—Common psychosomatic manifestations—Thyroid enlargement and other changes related to mineral content of drinking water—Psychopathology—Hospital and community—Bacterial and virus diseases—Eye diseases—Nutrition and diet therapy—Diseases of heart and circulation—Pharmaceutical pocket book—Disorders of sex and reproduction—Diccionario ingl s-espa ol y espa ol-ingl s de t rminos m dicos y biol gicos—Medical education—Recent advances in sex and reproductive physiology—Science and practice of surgery—Post-mortem appearances—Nomenclature of disease—Vade mecum of medical treatment—Textbook of gynaecology—Food and health—Les alg es des amput s—Short history of ophthalmology—Physics and the surgeon—Clinical chemistry in practical medicine—Treatment of chronic and 'incurable' diseases—An experiment in the employment of disabled men—Intelligence tests for children—Modern treatment year book 1948.

## Books Received

## Films

Bronchography  
Polio: diagnosis and management.  
The multiple pressure technique of vaccination  
Your children's meals; Your children's sleep  
Know your baby

## Guide to the Journals

## ASPECTS OF THE PSYCHOPATHOLOGY OF OLD AGE

### Revealed in Witchcraft Cases of the Sixteenth and Seventeenth Centuries

SONA ROSA BURSTEIN M.A.

*Wellcome Historical Medical Museum, London*

The hazards of senescence belong in large proportion essentially to the sphere of mental health. This appears now to be the considered verdict of both medicine and science. In 1948, problems of old age for the first time formed a distinct feature of the programmes of the British Medical Association and the British Association for the Advancement of Science, at their annual meetings in June and September respectively. At both meetings, papers and discussions emphasized the social and psychological disorientation which threatens the ageing individual in the pace and stress of contemporary living; at the British Medical Association meeting, the discussion on old age was included, significantly, in the section of Neurology and Psychiatry.<sup>84a, b</sup>

Old people are much in today's news. The increased longevity which is the proud achievement of improved medicine and hygiene has led to an unprecedented increase in the numerical proportion of the old-age group of the population. Medicine, science, changing birth-rate, war and migration have together created an imbalance, which population trends threaten to intensify. Consciousness of the effect of the strain of contemporary life on the aged is forced upon us by their very numbers. It was pointed out some time ago by Lord Amulree that many old people were suffering from underfeeding, not because of inadequate rations but because they could not stand in queues and carry home heavy parcels.<sup>94</sup> The implication is that much of the chronic sickness of the aged is due to current social conditions in the community. The truth seems to lie in the truism that old age is not a new thing, and that problems of adjustment to old age are as old as mankind.

Four hundred years ago old women were the news—bad news, dire news! An angry verbal passage-at-arms with a shrill-voiced hag—and a man would go home to frighten himself nearly or quite to death at the first aches or cramps that might come to him. The very sight of an old crone mumbling to herself could send children into convulsions and rouse a storm of mob excitement. *Wonderfull news from the North . . . ; Strange and terrible news from Salisbury . . . ; The most true and wonderful narration . . . ; A detection of damnable driftes . . .* with such headlines the pamphleteers, the reporters of the time, spread the tidings of witches brought to trial and doom, and so fostered suspicion and further convictions.

It is not the purpose of this paper to examine the long and complex history of belief in witchcraft, which reached its height in the 16th and 17th centuries. The antiquity of the worship which is at the basis of the witch-cult has been amply set forth by Margaret Murray<sup>55</sup> and others. Much literature and theory have been devoted to interpreting the records in the light of the belief of Montague Summers<sup>57</sup> or the scepticism of the late Henry Charles Lea,<sup>53</sup> authorities to whose industry and scholarship every student of witch-beliefs owes so much. Moreover, it is certainly proved beyond argument that, from the earliest antiquity to modern times, accusations, prosecution and punishment for witchcraft have fallen on people of both sexes and all ages. In the list of those executed for witchcraft in the town of Würzburg, for example, in the years 1627 to 1629, in which 151 names are recorded, there are as many men as women, and no less than thirty children.<sup>51 58</sup>

Nevertheless, at the height of the witch-trials of the 16th and 17th centuries, the vast majority of the accused were old women. Of this we have overwhelming evidence in the works of contemporary writers—philosophers, doctors, and jurists, both English and Continental; in the reports of indictments and trials; in contemporary pamphlets and ballads; and in folk-memory expressed in song, legend and literature at a later date. There is an undoubted challenge to those concerned with mental and social welfare in the question why, for two and a half centuries, suspicion of, and prosecution for, witchcraft constituted a major hazard of female senescence.

#### Evidence of Contemporary English and Scottish Writers

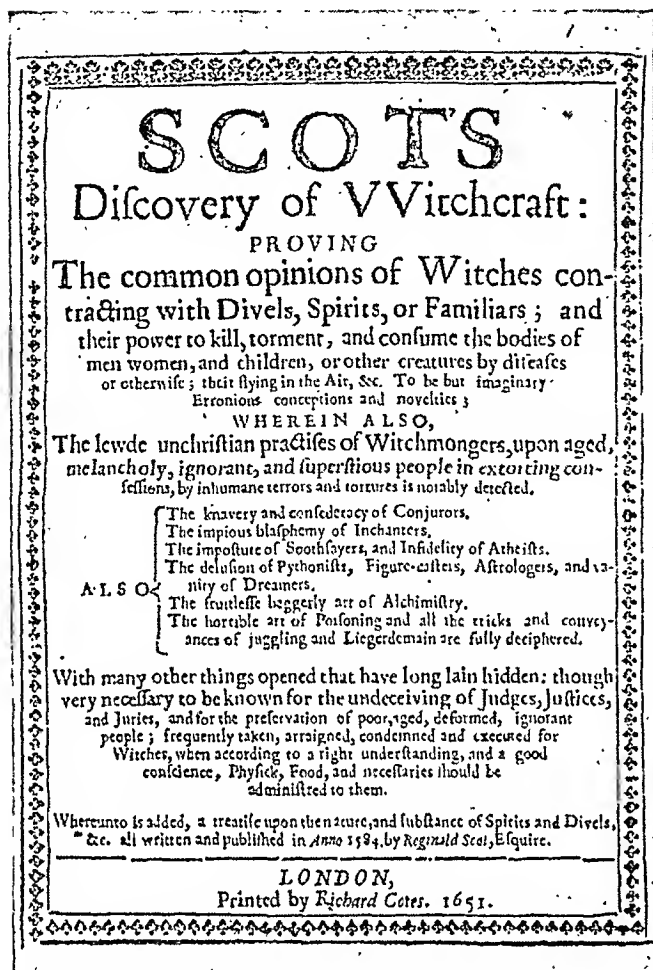
Reginald Scot, summing up the sceptic's case against witchcraft, says that witches "be commonly old, lame, bleare-eyed, pale, fowle and full of wrinkles . . . in whose drousie minds the divell hath gotten a fine seat; . . . leane and deformed, showing melancholie in their faces . . . doting, scolds, mad, divellish." Towards the end of the book he gives his definition of witchcraft as "in truth a cosening art . . . a supernaturall worke, contrived between a corporall old woman and a spirituall divell."<sup>22</sup>

A hundred years later, we find Joseph Glanvill setting forth the case for belief in witchcraft and persecution of witches with passionate conviction and all the sober, reasoned argument of the 17th century thinker. Yet even he has to find some way of answering the objection that "'Tis very improbable that the devil who is a wise and mighty spirit would be at the beck of a poor hag, and have so little to do as to attend the errands and impotent lusts of a silly old woman," and the fact that the "accused persons are usually crazy and imaginative old women."<sup>18</sup> William Perkins, too, in his *Discourse on the damned art of witchcraft*, indignantly rejects the expressed view that witches were "merely aged persons of weake braines and troubled with abundance of melancholie."<sup>20</sup>

Notestein quotes an English newspaper, *The Moderate Intelligencer* of September 1645, which has an editorial commenting on a current case, thus:

But whence is it that Devils should choose to be conversant with silly old women that know not their right hands from their left, is a great wonder . . . they will meddle with none but poore old women: as appears by what we have received this day from Bury . . . Divers are condemned and some executed and more like to be. Life is precious and there is need of great inquisition before it is taken away.<sup>56</sup>

FIG. 1. AN EARLY ATTACK ON WITCHMONGERS



Title-page of Reginald Scot's *Discovery of witchcraft*, 1651 edition.  
 (From a copy in the library of the Wellcome Historical Medical  
 Museum)

As late as 1668, when scepticism was well advanced, William Drage, "practitioner in physick", gives the following panacea for diseases caused by witchcraft:

Punish the witch, threaten to hang her if she help not the sick, scratch and fetch blood. When she is cast into prison, the sick are some time delivered, some time he or she (they are most females, most old women, and most poor) must transfer the disease to other persons, sometimes to a dog, or horse, or cow. Threaten her and beat her to remove it.<sup>14</sup>

John Gaule, vicar of Great Staughton, a contemporary resident in East Anglia at the time of Matthew Hopkins' great witch-drive in that region, and a credible witness in that he was himself a believer in witchcraft, writes: "Every old woman with a wrinkled face, a furred brow, a hairy lip, a squint eye, a squeaking voice, or a scolding tongue, a skull-cap on her head, a spindle in her hand, a Dog or Cat by her side, is not only suspected but pronounced for a witch."<sup>15</sup> There is no change here from Archbishop Harsnett's description, nearly fifty years earlier, of the accepted idea of a witch:

... an old weather-beaten croane, having her chinne and her knees meeting for age, walking like a bow leaning on a

shaft, hollow-eyed, untoothed, furrowed on her face, having her lips trembling with the palsie, going mumbling in the streets; one that hath forgotten her *pater noster* and yet hath a shrewd tongue in her head to call a drab a drab.<sup>16</sup>

Master Thomas Potts, who acted as clerk to the court in the notorious case of the Lancashire witches, has left us a faithful and accurate chronicle of what took place at the trial, with almost photographic detail of the "examinates". Describing the cross-examination of one of the principals accused in the case, Anne Chattox, "a very old, withered, spent and decrepit creature, her sight almost gone," he makes this significant remark: "... for the wrinkles of an old wives face is good evidence to the Jurie against a witch. And how often will the common people say *Her eyes are sunke in her head, God blesse us from her.*"<sup>17</sup>

Roger North, a distinguished lawyer who was at Exeter in 1682 when a famous witch trial occurred, wrote in a letter: "... They were the most old, miserable, decrepit creatures ... a painter would have chosen them out of the whole country for figures of that kind to have drawn from." Elsewhere he gives a vivid account of the popular excitement: "The women were very old, decrepit and impotent and were brought to the assizes with as much noise and fury of the rabble against them as could be shewed on any occasion. The story of their acts was in everyone's mouth ... all which the country believed and accordingly persecuted the wretched old creatures."<sup>18</sup>

Sir George Mackenzie, acting as counsel for the defence (permitted in Scottish procedure only) in a witchcraft case between 1660 and 1670, opens the final summing-up of his argument with these words: "Consider how much fancy does influence ordinar Judges in the trial of this crime, for none now labour under any extraordinary Disease but it is instantly said to come by Witchcraft and then the next old, deformed or envyed woman is presently charged with it."<sup>19</sup>

Blackstone,<sup>20</sup> referring to the laws of Henry VIII and James I, which made the practice of witchcraft a felony "without benefit of clergy" and punishable by death, says: "These acts continued in force till lately, to the terror of all antient females in the kingdom, and many poor wretches were sacrificed thereby to the prejudice of their neighbours and their own illusions."

#### Evidence of Contemporary Continental Writers

Continental writers are, if anything, even more explicit in attributing the witch-character to old women, whether in accusation, defence or rationalization. In 1550, the Italian physician and mathematician, Jerome Cardan, published a book, *De subtilitate*, in which he regarded witchcraft as an illusion engendered by poverty, hardship and lack of nourishment, but founded on some reality. He says:

What are we to think of those called *lamiae* or vulgarly *strigae*? They are miserable old women, beggars, existing in the valleys on chestnuts and field herbs and, but for a little milk, would starve. They are emaciated, deformed, with prying eyes, pallid, showing in their faces black bile and melancholy. They are taciturn, stupid and differ little from those called demoniacs. They are fixed in their opinions and so stubborn that, if one regard only what they so boldly repeat that is impossible, we should regard it as true.<sup>21</sup>

Cardan's countryman, Arnaldus Albertinus, in a tract published in 1572 asserting the existence of witchcraft and the guilt of witches, says that the latter are "mostly old

women who can find no lovers and become *strigae*, when they commit unspeakable things."<sup>11</sup>

The great pioneer in regarding the mentality and behaviour of old women—which exposed them to accusations of witchcraft—as manifestations of mental illness was Johann Weyer, known also as Wier or Wierus. In his book, *De praestigiis daemonum*, published in 1563, while proclaiming his own orthodox belief in witchcraft, he asserted the folly of attributing supernatural powers to old women, and denounced the cruelty of their persecution. In his introduction he says, "Witches are poor, ignorant creatures, old and powerless, who without instruction imagine themselves, in their desperation and degradation, to be the cause of the evils which God sends to man and beast." In the dedication he recapitulates with approbation the opinions of his patron, the Duke of Cleves, that old women, misled by devils, imagine that they cause the evils which happen to others whom they desire to harm. In accordance with this view, in the Duke's domains foolish old women were not put to death, and were punished only if there was a proved case of poisoning.<sup>26</sup> In the introduction to his second book, *De lamiis*, Weyer congratulates himself on the success of his efforts to diminish the slaughter of innocent old women, but as the tyrants have renewed their persecutions, he proposes to put his opinions into condensed form and to prevent the shedding of innocent blood.<sup>27</sup> His constant use of the diminutive—*mulierculae*, *aniculae*, *vetulae*—, in referring to the old women he defends, is worthy of note.

Frommann, writing in 1675 on "fascination", the evil eye and attendant phenomena, subscribes to the view that witchcraft is mostly practised by uneducated old women ("... indoctis magis quam doctis senibus magis quam juvenibus, mulieribus quam viris probari miretur nemo").<sup>28</sup> An occurrence quoted by Westphal in a book called *Pathologia daemoniaca*, published in Leipzig in 1707, indicates that the tradition of Weyer had taken some hold in the medical world, even in Germany, the stronghold of the belief in witches. The story is of an old woman who, in 1674, a century after Weyer was writing, confessed to congress with an incubus. She was handed over for medical examination; this in itself marks an enormous advance. Dr. Michael Ettmüller, in a long opinion given with much detail of symptoms, pronounced her insane and declared her intercourse with demons imaginary, and her "progeny" nothing but faecal discharges after severe constipation. The Medical Faculty of Leipzig concurred in this opinion and she was saved from the stake.<sup>29</sup> <sup>32</sup> The outstanding name in the conflict against persecutions for witchcraft in 17th century Germany is that of Christian Thomasius, of whom Frederick the Great said that he "vindicated the right of women to grow old in safety."<sup>31</sup>

In England, the chief protagonists for the defence of old women against witchcraft persecution were amateurs and laymen. Reginald Scot was a country squire, who with equal ability and enthusiasm devoted his leisure to writing on his two paramount interests—the defence of witches and the growing of hops. His evidence for the former is mostly drawn from the life and beliefs of the people. Continental witch-belief was far withdrawn from popular superstition and vulgar rumour. It was claimed as an exact science based on observations by able and enlightened men, and its arguments were founded on the scholarship

of generations. In the revised Criminal Code of Saxony of 1572, the opinions of Johann Weyer (*Wieri rationes*) in relation to witchcraft are derided as worthless because he was only a doctor, lacking the scholarship and precision of the jurist.<sup>45</sup> It is the very difference in the character of English and Continental witch-belief that makes the similarity of the witch-personnel in both cases of such vital significance.

#### Characteristic Senile Behaviour of Suspected "Witches"

There have not been wanting others than Weyer, with less conscious purpose, to point out, by explicit statement or by implication, that many of the old women involved were either crazed or doting. The characteristics of mumbling senility were undoubtedly taken as evidence. "None ever talked to themselves that were not witches," said a common witch-pricker.<sup>40a</sup> Potts describes old Mother Chattox with "her lippes ever chattering and walking; but no man knew what."<sup>45</sup> A manuscript of the time of James I deals with: "Circumstances to be considered in the cause of [Joane Harvy] the mayde of Hookham... for scratching of an old witch there [Mother Francis], now deade." In a marginal note, Mother Francis is described as "old and crazed and hurte by a fall." From the text we learn that she was aged about eighty and that the fall was out of bed—a danger well known to those who have charge of the infirm aged.<sup>1</sup>

Not least evident in the narratives is that type of senile psychotic behaviour arising from lack of comprehension of immediate reality or danger. Eighty-year-old Temperance Lloyd, we are told in a contemporary pamphlet,<sup>74</sup> went to the gallows "all the way eating and was seemingly unconcerned." Several accounts of the last witch-burning in Scotland, as late as 1722, tell of how the accused, described variously as "demented" and "a fatuous old woman", was quite unconscious of the stir about her as she was led to the stake and stretched out her hands to the blaze, chattering her pleasure at "the bonnie fire."<sup>42</sup>

The typical, irritable, discontented old woman, the village scold, with "a shrewd tongue in her head to call a drab a drab", seems generally to have been careless enough of her own danger. Over and over again it is this loud, aggressive behaviour which brings the woman into trouble. Elizabeth Sawyer, the witch of Edmonton, who was the very type depicted by popular belief "with body crooked and deformed, even bending together", confessed to the Rev. Henry Goodcole who visited her constantly in Newgate until her execution, that her "tongue... by cursing, blaspheming and imprecating... was the occasioning cause of the Divil's access unto her."<sup>33</sup>

In the case of the notorious fraud of the "Boy of Bilson", exposed by Bishop Morton in 1620, the boy, William Perry, being asked why he had accused this particular old woman of causing his pretended "possession", replied that "she being known to him and of a *scolding humour*, he fixt it on her." Arthur Wilson, James the First's chronicler, who recounts the story, says that the old woman "had no good reputation among the Neighbours, being of a tetric and froward temper incident to old age." The good bishop seems to have been well ahead of his time in assessment of both senile psychology and juvenile delinquency, for he took the young exhibitionist into his own home and educated

him: "Thus", says Wilson, "did the Bishop preserve an innocent old woman condemned by the Law to die . . . and convert a wicked boy whom afterwards he bound Apprentice and proved a good man."<sup>28</sup>

A witchcraft trial which took place in Württemberg early in the 17th century (1615-21), casts considerable light on the communal psychological situation. This was the case of the mother of the famous Johann Kepler. The "Keplerin", as she was called, deserted by a thriftless husband, soured and embittered by misfortune, made morose and eccentric by solitude, was accused of witchcraft by a neighbour whom she had insulted. Her astronomer son, defending her, was under no illusion as to her temper. He described her as "small, thin, swarthy, sharp-tongued, quarrelsome, of evil mind," and a disturber of the whole community. In a letter he writes:

Rumour is an evil than which none is swifter; for this suspicion spread at once among highly superstitious folk, since they based their argument on the seventy years' age of my mother and on several of the faults with which my mother is burdened, which are lying, prying, violent anger, cursing, persistence in complaints, which vices at that age are very common . . .<sup>30</sup>

Giffard<sup>17</sup> sketches a deft picture of how a witchcraft accusation may arise from local quarrels:

Some woman doth fall out bitterly with her neighbour: there followeth some great hurt . . . There is a suspicion conceived. Within a few years she is in some jarre with an other. This is noted of all. Great fame is spread of the matter. Mother W. is a witch . . . Well, Mother W. doth begin to be very odious and terrible unto many, her neighbours dare say nothing but yet in their hearts they wish she were hanged. Shortly after an other falleth sicke and doth pine . . . Everyone sayth now that Mother W. is a witch in deede . . . It is out of all doubt.

#### Contemporary Interpretations of the Behaviour of Supposed Witches

Reginald Scot prefixes his *Discoverie of witchcraft* with an epistle to his kinsman, Sir Thomas Scot, in which he covers a whole range of senile psychotic behaviour and makes some acute observations on cause and effect. He pleads,

. . . that lawfull favour and Christian compassion be rather used towards these poore soules, than rigour and extremitie. Because they, which are commonlie accused of witchcraft, are the least sufficient of all others to speake for themselves; as having the most base and simple education of all others; the extremitie of their age giving them leave to dote, their povertie to beg, their wrongs to chide and threaten (*as being void of any other waie of revenge*), their humor melancholicall to be full of imaginations, from whence chiefly proceedeth the vanities of their confessions: as that they can transform themselves and others into apes, owles, asses, dogs, cats &c.; that they can flie through the aire, kill children with charms, hinder the coming of butter &c.

The confessions of the accused have been taken variously as proving the reality of their guilt or as the ramblings of insanity, shaped by current belief. Most of the confessions were certainly made under duress, whether of the rack of the Continental courts, the "boots" and "pennywinkis" (a kind of thumb-screw) of the less ceremonial torture of Scotland, or in England, where official torture was not permitted, the refinements of the witch-hunter's third-degree methods—"floating", maintaining for hours a strained and painful position, keeping from sleep for many nights and days, "walking between two" up and down a room to the limits of endurance of feet and heart and brain. Of the confessions made without apparent coercion, it has to be

FIG. 2. TESTING A SUSPECTED WITCH BY "FLOATING"

Witches Apprehended, Examined and Executed, for notable villanies by them committed both by Land and Water.

With a strange and most true triall how to know whether a woman be a Witch or not.



Printed at London for Edward Marchant, and are to be sold at his shop ouer against the Crosse in Pauls Church-yard. 1613.

Title-page of an account of the trial of Mother Hutton and her daughter Mary at Bedford in 1612. (From a contemporary pamphlet<sup>10</sup> in the Bodleian Library, Oxford)



remembered that many were made in the hope of gaining the mercy of the courts, were it only the mercy of strangling before burning. Further, most of the accused fully believed in the existence of the powers attributed to them and we find not a few cases of women asking sincerely if it were possible they could have committed these grievous sins without knowing.<sup>58</sup> Mary Smith, in 1616, made a full confession for her soul's salvation and died on the gallows in great penitence and piety, fully believing herself to have been a witch.<sup>6</sup> Nevertheless, there was a large number of spontaneous confessions as surprising and puzzling to contemporary observers as to later inquirers. North observed of the women at the Exeter trial: "The evidence against them was very full, but their own confessions exceeded it. They appeared not only weary of their lives but to have a great deal of skill to convict themselves."<sup>33</sup>

The "humor melancholicall" which, according to Scot,<sup>22</sup> makes old women "full of imaginations", is a theme to which he constantly reverts. Two of the chapter-headings of Book III of the *Discovery* run: (Chap. X) *How melancholie abuseth old women and of the effects thereof, by sundrie examples*, and (Chap. XI) *The strange and divers effects of melancholie and how the same humour abounding in witches, or rather old women, filleth them full of marvellous imaginations and that their confessions are not to be credited*. "Melancholy" is a common diagnosis of the time. A 16th century manuscript in the British Museum, written by an unnamed Kentish man, who had certainly read and digested the works of Weyer and Scot and other sympathetic writers, repeats this second chapter-heading almost verbatim and adds: "If our witches fantasies were not corrupted, nor their wills confounded with this humor, they would not so voluntarilie and readilie confess that which calleth their life in question."<sup>22</sup>

Webster, exposing the fallacies of supposed witchcraft, wrote of "divers persons under a passive delusion of Melancholy and Fancy."<sup>25</sup> Burton, in the *Anatomy of melancholy*, says: "This natural infirmity is most eminent in old women, and such as are poor, solitary, live in most base esteem and beggary or such as are witches; insomuch that Wierus, Baptista Porta, Ulricus Molitor, Edwicus, do refer all that witches are said to do, to imagination alone, and this humour of melancholy."<sup>12</sup>

Arthur Wilson (1653) saw nothing in the women condemned at Chelmsford "other than poor mellencholie . . . ill-dieted, atrabilious constitutions, whose fancies working by grosse fumes and vapors might make the imagination ready to take any impression."<sup>28</sup>

Weyer, the doctor, would have the "evil deeds confessed" minutely inquired into, as to the validity of the alleged means and effects and also

as to whether there be any melancholy or mental disorder . . . In this business there is much of turbulence, of suspicion, of malignity; much is confusedly disseminated about others. The confessions of old women deluded by demons are accepted and the judge who lends a facile ear to accusations and confessions will find himself deluded and involved in an inextricable labyrinth . . . How can faith be reposed in confessions made by those not in their right senses? And if these old women confess lies, it vitiates the whole confession.<sup>27</sup>

Elsewhere referring to the trials of Job and the madness of Nebuchadnezzar, Weyer continues:

It is fortunate that they are not among us today, for if they were hereabouts, some old woman would shoulder the responsibility for their distress, and the brains of these old women

are so inflamed that, under torture they would confess to having caused all these terrors.<sup>25</sup>

It is interesting to note that, while modern scholarship piles up research and argument to prove that the attribution of the witch-character to women, of whatever age, derives from ancient cults of mother-goddess and earth-goddess, to those who lived in the centuries of witch-belief it was something inherent in female nature. Whether seen in the shadow of the passionate misogyny of the *Malleus maleficarum*<sup>24</sup>, that 15th century vade-mecum of all witch-hunters, or in the light of Weyer's healing kindness, woman was weak, excitable, liable to deception and fit for diabolic illusions.<sup>24</sup> Scot quotes from Leonhardus Vairus: "And therefore, he sayth . . . women are oftener found to be witches than men: For (sayth he) they have such an unbridled force of fury and concupiscence generally . . . and of all other women, leane, hollow-eyed, old, beetle-browed women (sayth he) are the most infectious."<sup>22</sup>

As early as 1550 Cardan attributed the witch-behaviour of old women to want, hunger and hardship. Weyer constantly refers to their poverty. The dependence on charity is specially notable in the English narratives. Webster in 1677 laughs to scorn the idea "that the Devil should carry an old Witch into the air into foreign regions, that can hardly crawl with a staff, to dancing and banqueting, and yet to return with an empty belly and the next day be forced, like old Dembdike or Elizabeth Sothernes," (i.e. the Lancashire witches) ". . . to go a-begging with the sour-milk can."<sup>25</sup>

The pattern of the curse which followed the refusal of alms is endlessly repeated in the narratives. Such is the story told by Glanvill<sup>18</sup> of Julian Cox and the maid-servant said to have been bewitched by her. Says Scot in his introductory epistle:

May it please you to waie what accusations and crimes they laie to their charge, namelie: She was at my house of late, she would have had a pot of milke, she departed in a chafe because she had it not, she railed, she cursed, she mumbled and whispered, and finally she said she would be even with me: and soon after, my child, my cow, my sow, or my pullet died, or was strangellie taken . . .

In a pamphlet published in 1687,<sup>8</sup> giving an account five years after the event of the trial described by North, we read that the judge ". . . in his charge to the jury gave his opinion that these three poor women (as he supposed) were weary of their lives, and that he thought it proper for them to be carried to the Parish from whence they came, and that the Parish should be charged with their maintenance; for he thought their oppressing Poverty had constrained them to wish for death."

The authors of the play *The witch of Edmonton*,<sup>21</sup> written in 1658, put a shrewd summing-up of the situation into the mouth of Elizabeth Sawyer:

Why should the envious world  
Throw their scandalous malice upon me,  
'Cause I am poore, deform'd and ignorant  
And, like a bow, buckled and bent together?  
Must I for that be made a common sink  
For all the filth and rubbish of Men's tongues  
To fall and run into? Some call me Witch;  
And, being ignorant myself, they go  
About to teach me how to be one; urging  
That my bad tongue (by their own malice made so)  
Forespeaks their Cattle, doth bewitch their Corn,

Themselves, their Servants, and their Babes at nurse.  
Thus they enforce upon me; and in part  
Make me to credit it . . .

Act II, Scene I

### Modern Medical Interpretations

Some individuals living at the time, with every excuse of training and social pressure to regard these old women as enemies of society, could make thoughtful interpretation of the behaviour of both persecutor and persecuted. A Johann Weyer could blaze a trail for the modern alienist. Yet doctors of later times have tended to relegate the whole matter of witchcraft to the antiquarian and the folk-lorist, as if the very type and character of the witch-suspect disappeared with the last recorded burning or hanging. "The undiscovered country of witch pathology," says Kittredge, "awaits its trained explorer."<sup>61</sup> And Zilboorg makes the reproach: "As the fires of the Inquisition stopped burning, so did the fires of compassionate medical curiosity."<sup>62</sup>

Nevertheless, there is not complete silence. Alienists of the later 19th century such as Hack Tuke and Maudsley<sup>63</sup> make reference, albeit briefly, to the witchcraft records as of some value in their work with the insane. Tuke declares that "it is impossible to read the narratives of some of the unfortunate hags who were put to death for witchcraft, without recognizing the well-marked features of the victims of cerebral disorder."<sup>78</sup>

In Germany, Kirchhoff, after a careful study of the original records of the witch trials, stated that he often found the reported answers and conversations exactly like those familiar to him in asylums for the insane. He names some forms of mental disease (notably dementia senilis and epilepsy) which, he considers, constantly and unmistakably appear among those who suffered trial for witchcraft.<sup>66</sup> Snell also made detailed investigations into psychological aspects of the witch trials, with a view to application to psychiatric studies.<sup>74 75</sup> He points out that the mentally sick person may be the accused or the accuser, and mentions that self-accusation of serious crimes is a recognized symptom of mental disorder.

A series of articles<sup>70a, b, c</sup> on the "State of Society, Past and Present, in Relation to Criminal Psychology" appeared in 1881-3, from the pen of David Nicolson, deputy-superintendent of Broadmoor Criminal Lunatic Asylum. This contribution, sadly isolated in outlook and treatment of its subject, presents the suspected witches in the setting of their daily life and neighbourhood, and attempts an assessment of the social implications of the persecutions. As a pioneering effort it is worthy of lengthy quotation:

In the study of criminal trials, such as those with which we are at present concerned, we are brought face to face with the social phenomena of the time being in all their bearings and, in the cases here given, there will always be found something of psychological interest, either as regards the domestic and other concerns of the community or as regards individuals prosecuted or individuals prosecuting. The evidence, where given, will throw light upon the different ways that people had of looking at their relationships and of interpreting the circumstances taking place around them.

Sometimes the eccentric or insane appearance or conduct of the individual will be found to have given rise to an accusation founded on a *bona fide* belief in the individual's actual or potential guilt. Sometimes the insanity will reveal itself in wild and ecstatic utterances of the individual at whose instiga-

tion or upon whose evidence a charge is sustained against a reputable and unoffending neighbour. Sometimes the mixture of hysteria or epilepsy with a malicious or criminal disposition will mask the real character of the case and give, as in any form of criminal charge, grounds for the expression of honest though contradictory opinion on the two sides.<sup>70a</sup>

Proposals to honour the memory of Sir Thomas Browne in 1904 brought an indignant letter to the *British Medical Journal* from the Irish alienist, Conolly Norman, recalling how Browne's "expert testimony" in 1664 secured the conviction and execution of two women tried for witchcraft before Sir Matthew Hale.<sup>72</sup> A lively correspondence followed this letter, which created a brief flare-up of interest in the subject of witchcraft and medical responsibility; but, brief as it was, the discussion tailed off into historical reminiscence before it died down. In the following year, Norman published an interesting study on the reappearance among modern paranoiacs of notions having the closest connexion with old witchcraft delusions. He suggests that the wonder-working delusional inspirations of the insane are taken from the material provided by their own times, e.g. in the 20th century from such developments as electricity and the phonograph.<sup>73</sup>

The New England witchcraft excitement of 1692, brief but intense and bitter, roused some modern medical curiosity by its local character and the completeness of its documentation.<sup>61 62 70</sup> Taylor<sup>70</sup> comments on the remarkable lack of critical interpretation of witchcraft phenomena from a medical standpoint, but in his own interpretation concentrates on "the pathological significance of the disorders observed in the bewitched persons" with no reference to the character of those accused. Caulfield<sup>62</sup>, on the other hand, begins by taking the suspected persons into review: "Goody Osburn, a sickly old creature, who later at her trial admitted that she suffered from vivid dreams"; "old Sarah Good, a pipe-smoking, disorderly, somewhat demented beggar." His paper is paediatric in intention, but he does not miss the significance of the "afflicted children's" selection of these old women for accusation, and brings out well the suggestibility of children brought up in the peculiar atmosphere of Puritan New England.

Tramer's paper,<sup>77</sup> again concerned with child psychology in relation to the witch-beliefs and trials, also draws attention to the type of ragged, hunch-backed, dishevelled, emaciated old woman presented to child-belief as a witch. One or two other authors have referred the suspect behaviour of supposed witches to schizophrenia and epilepsy<sup>64</sup>, to trance-mediumship or essays in extra-normal experience<sup>61</sup>, or to unrealistic symbolism.<sup>64</sup> The remaining few who have concerned themselves with witchcraft and medicine have been mostly interested in the belief in the magical causation of disease.<sup>63</sup> Zilboorg, in his *History of medical psychology*, and other contributions<sup>81 82 115 116</sup> alone gets the phenomena of witchcraft into a true perspective in medical, psychological and social history. But the problem still awaits handling by the geriatrician.

### Psychological and Social Sources of Prejudice Against Old Women

The psychopathology of old age is now beginning to be well documented.<sup>83-105</sup> In 1931 Critchley anticipated the present preoccupation with psychological phenomena of ageing<sup>66</sup> and, as early as 1896, Scott<sup>102</sup> had some good

things to say about reactions to old age viewed as the diminuendo of life. Hall's book on senescence,<sup>92</sup> which appeared in 1923, stands in a class by itself; it was the rounding off, in retirement, of a professional career which had already contributed full and specialized treatments of the phenomena of adolescence and maturity. It is only within the last decade that the mental state of old people, and the happiness or unhappiness of their reciprocal relations with the community, have come to be realized as a factor to be reckoned with in communal welfare.

The published results of research reveal a recognizable pattern of senile psychosis, with recurring traits such as neglected appearance, forgetfulness, confused and agitated behaviour, incomprehension of personal danger, and a variety of antisocial psychopathies ranging from mild suspiciousness to homicide, imagined or actual. These and other related traits become familiar to the point of monotony in any intensive reading of the original witchcraft data.

East, in an important paper on the aged criminal offender,<sup>89</sup> draws from his own medicolegal experience conclusions for which endless evidence could be found in the witchcraft records. He quotes, among other illuminating cases, that of a man of 75 who had murdered his landlady for alleged reasons based on "delusions inherently incongruous." The behaviour of this man at the medical inquiry into his mental condition, *after* the trial at which he had been found guilty and sentenced to death, is strongly reminiscent of that of many of those accused as witches, as described in the 16th and 17th century narratives. East observes:

Confusion of thought . . . unwarrantable distrust of others and suspicions regarding events, restlessness and resistiveness mark the passing of normal senescence into abnormal senility and suggest to the forensic psychiatrist the lines upon which to shape his evidence in a criminal court.

The question of responsibility and culpability, in actual or imagined crimes, was not unthought of by the contemporaries of the supposed witches. Selden<sup>93</sup> would have had them punished even by death for malicious intent, declaring:

If one should profess that by turning his hat thrice and crying buz, he could take away a man's life, though in truth he could do no such thing, yet there is a just law made by the State, that whosoever should turn his hat thrice and cry buz, with an intention to take away a man's life, shall be put to death.

Diefenbach quotes a whole series of doctors of the time who professed very similar views.<sup>47</sup> Zilboorg<sup>117</sup> reminds us that what we now know as "neurosis" and "personality deviations" presented no problems to the physicians of those days, not because these deviations did not exist, but because they were all "commonly understood to stem from ill will, which covered the whole length of the series from mere naughtiness and prankishness to psychopathies and criminality. The concept of ill will was the most dynamic and potent one in the history of witch-hunting." Weyer took the view we should expect of him: "If one holds that witches are to be severely punished for their evil intent, let it be remembered that there is a great difference between sane and insane will".<sup>95</sup> But it is the layman, Scot, who takes us to the heart of the matter, giving us a sharp reminder of helpless old women caught up in an unhelpful world. "Their wrongs," he cries, give them leave "to chide and threaten, as being void of any other waie of revenge."<sup>92</sup>

Insanity alone is a too easy explanation. Ackerknecht<sup>90</sup> gives us a timely reminder that "being different is not yet being psychopathological" and points out that the psychopathology of the odd ones of society, such as homosexuals, mulattos or hunchbacks, is due "much more to their ambiguous position than to their organic structure." For more than two centuries, old women were unquestionably among the odd ones of society and had a distinctly equivocal position. The centuries of the witch persecutions were a time of social stress, of changing economy, of storm and clash of creed. The issues became as confused in the minds of the constituted authorities as of the people; the passionate fight against heresy and apostasy became identified with the ancient hatred of witchcraft.<sup>81</sup> For the underlings of society—the poor, the infirm and the old—there was little joy in Elizabeth's Golden Age, the age of discovery and invention, of the rebirth of science and the revival of letters. As long as a Glanvill could fight with equal vigour and enthusiasm both for the Royal Society and for witch-belief, it was not the defence of science that affected these vulnerable ones.

Reviewing the factors contributing nowadays to mental disease in old age, Stieglitz<sup>104</sup> says, "migration from rural to urban areas, with the greater complexity of life, puts many old people in the category of being incompetent to continue free in society." Geriatricians today have found in cases of senile psychosis that the precipitating agency into psychosis is most frequently some form of loss of social integration, as loss of home or spouse or other relative, or a feeling of insecurity, defeat, or humiliation.<sup>87 88 99 105</sup>

Numbers of poverty-stricken old women who had outlived family and friends, or been left behind by them in the migration in quest of easier living, must have been caught up into that time of intensified religious emotion and fear, economic distress and general bewilderment. The prevalent beliefs in witchcraft provided ready-made moulds for the fancies of any sick or unhappy mind seeking satisfaction in the delusional transformation of reality. Their very appearance, behaviour and tormented bad temper would make these old women ready scapegoats for a sick and oppressed society.

Defoe, the man of many indignations, writing in 1727, found in the witch-persecutions evidence for his "complaint against the brutality of the present age: particularly the pertness and insolence of our youth to aged persons . . ." He says: "Those were brave days for young people, when they could swear the old ones out of their lives and get a woman hanged or burnt for being a little too old . . . and as a warning to old ancient persons, who should dare to live longer than the young ones thought convenient."<sup>108</sup>

In 1767, Stephen Fovargue catalogues witch-belief as a vulgar error, along with beliefs that negroes are not a part of the human species, and that the hedgehog is a mischievous animal.

It may be objected here that former legislators have thought proper to allow a reward to be given for killing this animal . . . to which I answer that legislators have thought proper to burn old Women, for being Witches . . . and I will venture to affirm that there is just as much sense in burning a Witch as in setting a Reward upon a Hedge-Hog.<sup>110</sup>

An early socialist hymn of 1849, on "The Days that are Gone", sings of

When famine and age made a woman a witch  
To be roasted alive or be drowned in a ditch.

Thus later popular and literary memory provided its own diagnosis.

Yet another aspect is provided by some of the contemporary evidence. White, in his *History of the warfare of science with theology*,<sup>58</sup> quotes physicians of the time of Weyer as deprecating interference with the existing belief in witchcraft because it seemed to them a "very safe belief to be held by the common people." Something of this attitude seems to have been present in the episode described in a letter from a friend to Cornelius Agrippa, the teacher of Weyer. He writes of "a certain decrepit old woman," who

being exposed . . . to dire tortures, confessed herself, under excruciating pain, to be a witch, to have denied Christ, on the suggestion of an incubus, to have flown through the air, to have raised storms, to have inflicted damage and disease on man and cattle.

After she had been convicted and duly burnt, Savin, the master of the heretics, publicized and emphasized the details of the confession and incited the populace to a witch-hunt. To us moderns, unhappily aware of lynching and pogroms in our own times, there is something horribly familiar in the lines that follow: ". . . There is a murmuring of the mob against poor little women, a detestable hatred springs up. Here and there the peasantry confer together and many crippled old women are seized, but most run from the danger."<sup>59</sup>

#### The Problem for Mental Science

The history of witchcraft of the 16th and 17th centuries is apt to be obscured by clouds of theory and dogma concerning cult and occultism. Davies's book<sup>46</sup> is perhaps unique in its treatment of the witch-beliefs as a functioning part of the mosaic of major events and minor happenings that make the pattern of contemporary history. Probably the truest picture is that given in the pamphlet literature; allowing for the newsmonger's sensationalism, it is easy to extract the residuum of fact—the position of the accused witch in her community, the real ground of the feeling against her on the part of her neighbours, the way in which the alarm spread, the processes used to elicit confession.

The investigator is beset with warnings. "Each country has its own type of witchcraft."<sup>59</sup> While England had its Matthew Hopkins and Scotland its "common witch-prickers" exploiting popular fear to the tune of twenty shillings search-fee per village plus twenty shillings per head for every witch brought to judgement, even the more scholarly and ritual attitude towards witches in Germany could tolerate its *Hexenspiörer*, its Lutherus Einhorn to pursue Kepler's mother with all the bitterness of his slogan, "To the stake with all old women."<sup>59</sup> Another warning is in the oft-repeated argument that it was not only aged

women who were prosecuted for witchcraft or were professed practitioners of sorcery. This is equivalent to arguing that, because patients of all ages are subject to chronic illness, the urgent need for beds for the chronic sick is not specifically a problem of geriatrics. The weight of evidence in both cases is on the side of the overwhelming numerical preponderance of the old.

A serious and more valid warning is against the danger of projecting the values of our times into the experiences of those days. Ackerknecht<sup>60</sup> reminds us that what is regarded as psychopathological behaviour now may have been normal in other times and conditions, and Maudsley<sup>61</sup> recalls that the same caution applies to the diagnosis of insanity from behaviour, in the circumstances of different, though contemporary, strata of society.

When all these doubts and differences have been cleared away, there remain certain phenomena bearing such strong resemblance to phenomena of our own times that we may be justified in believing that their study will reveal some permanent laws of cause and effect. There is today a growing tendency for doctors to be reminded that "patients have families"<sup>114</sup> and to pay more and more attention to the social history of the patient. There is also an increasing trend towards the study of the nature of persecutions, analyzing the psychology and reciprocal relations of hunter and hunted, the oppressor and the oppressed, the holder and object of prejudice.<sup>107 109 111 113 115 116</sup>

The old women who were accused of witchcraft had families and neighbours with whom they passed their daily lives, sharing their poverty or depending on their prosperity. They lived in times when, on the one hand, the now known features of senile psychosis could be sometimes driven over the borderline from mild confusion to raving insanity, sometimes aggravated into a desperate hostility towards society; and when, on the other hand, all the prejudice of society was concentrated against old women—even the most helpless and harmless—to such an extent that children were impregnated with it from their nursing days. "For," cried Reginald Scot,

. . . the world is now at that stay . . . that even as when the heathen persecuted the christians, if anie were accused to beleve in Christ, the common people cried *Ad leonem*: so now, if anie woman, be she never so honest, be accused of witchcraft, they crie *Ad ignem*.<sup>21</sup>

The striking problem which emerges for mental science is that of a twofold antisocial psychopathy—of society against old women and of old women against society. Our easy assumptions about what is "natural" in human reciprocal relations need to be re-examined in the light of how these assumptions change or endure with change of time or circumstance. By such examination, much light may be shed on some of the darker problems of our own day.

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## HYPNOTISM AND SUGGESTION: THEIR PLACE IN PSYCHOTHERAPY

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Hypnotism and suggestion have been studied for many years by observational methods, but it is only quite recently that experimental techniques have been brought to bear upon them. The first piece of research work done at the Institute of Experimental Psychology at Oxford after its foundation in 1935 was on this subject: much work has also been done in the USA. Let me come at once to the central problem: What is the nature of the hypnotic trance? Are there definite,

objective, physical criteria associated with this condition? The extent to which the term "hypnosis" can be applied still awaits determination, but the mental state which undoubtedly deserves this term is the hypnotic trance. This may be defined as a secondary state of mind, produced by definite methods—not one single method—leaving behind it amnesia or loss of memory for that particular mental state, and at the same time, or alternatively, involving pronounced anaesthesia to painful sensations. It is, in other words, a condition of artificial somnambulism.

This state of artificial somnambulism was first recognized by the Marquis de Puységur in 1784. In the course of his researches, he was fortunate in meeting a shepherd boy named Victor, a subject who readily passed into a state of *lucidité* in which he seemed to be aware of things not otherwise known, some of these things proving to be accurate when tested. This started a furore which is described by Pierre Janet (1919) in his great book, *Les médications psychologiques*. As the whole subject was frowned upon by the medical profession, medical men who took part in this work had to disguise their activities. Is this state of *lucidité* genuine? There is no question that there are plenty of fakes, and that often it is not genuine. Such cases must be investigated very strictly indeed; the imagination is so vivid, and subconscious influences so profound, that deception, and even self-deception, is possible and perhaps frequent.

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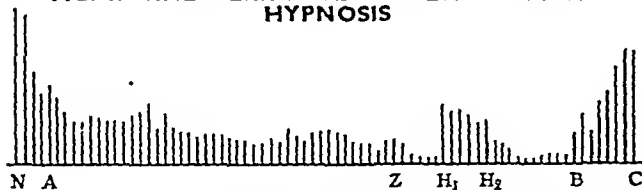
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*Laboratory Studies: the Electroencephalograph*

In the latest experimental work the electroencephalograph has been employed, and work with this instrument is described in an article by J. B. Dynes (1947) of the Lahey Clinic, Boston, Massachusetts. In 1936 A. L. Loomis published an article in the USA in which he studied one single case, comparing the state of hypnosis with the state of sleep. Loomis found that the electroencephalogram of the subject in hypnosis was indistinguishable from that of the same person awake, but quite different from that obtained in normal sleep. Loomis, unfortunately, did not publish his electroencephalograms; Dynes, however, verified these results, experimenting with five good hypnotic subjects. His published diagrams make it perfectly clear that these subjects, in a state of somnambulism with subsequent amnesia, and with insensitivity to ordinary painful stimuli, gave the same kind of electroencephalogram in the hypnotic state as they did when awake.

In 1931 M. J. Bass, working in the USA, studied the changes in the knee-jerk in the subject under hypnosis, and recorded the response in kymographic tracings. He discovered that as the subject falls more and more deeply asleep the knee-jerks diminish until they practically disappear. In the hypnotic state, on the other hand, although outwardly he may seem to be asleep, his knee-jerks remain. Dr. W. Stephenson and I repeated this work at Oxford in 1936, and verified that the state of hypnosis is an active one, in which the tendon reflexes persist. I give the record of the knee jerks of one undergraduate subject, 22 years of age, from my book, *Psychological methods of healing* (Brown, 1938).

**FIG. 1. KNEE-JERK MEASUREMENTS DURING HYPNOSIS**



(Reprinted from Brown, *Psychological methods of healing*, fig. 1, p. 117.)

Each vertical line is the average of 4 consecutive measurements of the knee-jerk stimulated at 10 sec. intervals.

N : normal knee-jerk, subject wide awake

A : suggestion, "Go to sleep", given; and repeated at intervals between A and Z

Z : development of hypnoidal state

H<sub>1</sub> : right arm catalepsy on strong suggestion that subject cannot drop the arm. Note reinforced condition of knee-jerk

H<sub>2</sub> : return to relaxation with suggestion

B to C : gradual return to waking state and to normal knee-jerk

Gradually, as I suggested sleep to him, the knee-jerk became less and less, down almost to nothing; as soon as I began to give any other kind of suggestion, to which he responded although he remained perfectly passive and quiet, back came the knee-jerk. Only when the hypnosis passed into a state of sleep again did the knee-jerk disappear once more (fig. 1). In a sense, therefore, hypnosis is active and sleep is passive; every objective test which we can devise points in the same direction.

*Clinical Application of Hypnosis*

In my own work, in the First World War, I was concerned with thousands of cases in the British Fourth Army in France from 1916 to 1918. Some 600 cases showed pronounced amnesia in addition to other functional nervous symptoms, and most of these cases were very easy to hypnotize. In 125 cases of amnesia with functional aphonia the ability to speak was restored when their lost memories were recalled under hypnosis. I found that one had to be firm and emphatic with them, in order to overcome the resistance they subconsciously put up to the recall of their terrifying front-line experiences.

What are the objections to hypnosis? Hypnotic trance can be produced in about 20 or 30 % of apparently normal people, but it is most easily produced in people with functional dissociation, especially functional amnesia. When such a person is hypnotized and the memory restored, and with the memory sometimes other lost powers such as walking and talking, the patient is left hypnotizable and likely to become more and more so with repeated treatments. He also becomes more and more dependent on the hypnotist. Psychological methods of re-association and unification of the patient's mind have to be employed to neutralize these bad effects. This means the systematic use of analytical psychotherapy to complete the treatment.

*The Use of Suggestion*

For these reasons I use hypnosis as little as possible in my practice. I use instead the suggestion of relaxation; this checks the onset of any deep hypnotic state or trance in most cases. If the subject is easily hypnotizable, he can of course be put into a hypnotic slumber from which he wakes up unable to remember what has happened. But if, before waking him up, the suggestion is given that he will remember everything on waking, the suggestion always works and he becomes re-associated and, in consequence, less hypnotizable than he had been previously.

The relaxation of the muscles by suggestion does not make the subject more hypnotizable, but rather the reverse. There is a difference between hypnosis and suggestion, although they are most intimately related. The great discussion in France toward the end of the last century was between Charcot, who described hypnosis as a mental dissociation or "artificial hysteria", and Bernheim, who repeated Charcot's experiments and defined hypnosis as "an artificially increased suggestibility". Bernheim was wholly right, but Charcot was not entirely wrong. Charcot dealt with very easily hypnotizable subjects, whereas Bernheim had a predominantly therapeutic purpose. In dealing with cases of functional disorder, one always wishes to strengthen their will, but with deep hypnosis one is sometimes working in the opposite direction. Hypnotism is indeed a mental drug: it paralyzes the will, unless supplemented by more active psychotherapy.

Suggestion, on the other hand, is a successful appeal to the unconscious. Therapeutic suggestion is not bluff; the suggestions made are, or should be, in harmony with reason. The doctor says to the patient: "You can get well by a change of mental attitude and outlook, because you are suffering from a functional nervous trouble." Progressive relaxation can be secured (by deep breathing and

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## SHOULD ANTHROPOID APES BE EXCLUDED FROM THE HUMAN FAMILY TREE?

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I am sure that if anthropoid apes, such as the gorilla and chimpanzee, were acquainted with recent anthropological and anatomical literature, they would be incensed about the strictures passed on them by Professor Wood Jones. Away back in the sixties and seventies of the last century Darwin and Huxley hailed them as man's nearest surviving relatives; ever since, they have been given that high place by practically everyone who has dealt at first hand with the problem of human evolution—all save the author of the book<sup>1</sup> now before us. It is now thirty years since Professor Wood Jones turned his back on the anthropoid apes and excluded them ignominiously from any place in the evolutionary tree of mankind. In his most recent work, *Hallmarks of mankind*, there is no sign of softening; on the contrary, his attitude is now almost vindictive. Being gifted with those mental qualities which give men eminence at the Bar—clarity of thought, an easy flow of ideas and phrases, a style of writing which is at once attractive and emphatic—the case he has now stated would carry an uninformed jury with him. What I have against his statement of the case is that it is entirely one-sided; the “pros” are emphasized, the “cons” are omitted. The anthropoids are in need of a defender.

One can see the first signs of a changed outlook on evolutionary problems in the excellent book Wood Jones published in 1916 with the title *Arboreal man*. In that work we meet with traces of uneasiness about how man

<sup>1</sup> [For particulars, see Book Reviews, p. 122.]

had come by his ‘primitive’ structural characters. In 1918 came what may be called his confession of evolutionary faith; it was but a booklet, with the title *The problem of man's ancestry*, but it contained all the arguments and evidence now restated in the *Hallmarks*. To account for the presence of man's primitive features and the absence of simian or apish characters, Professor Wood Jones believed it to be necessary to go back to the infancy of mammalian life and bring man off from the primate stem, before that stem had given origin to Old World monkeys and anthropoid apes. He agreed then, and indeed still does, that man and anthropoid apes have a great number of structural resemblances but holds that man and ape came by these resemblances independently. The pro-anthropoid evolutionists, on the other hand, hold that man and anthropoids have so many characteristics in common just because they have arisen from the same primate stem.

The argument of 1918, formulated as the First World War came to an end, concluded with an ethical note which does not appear in *Hallmarks*, but which I believe has influenced the author now in drawing up his scheme of human evolution. This ethical apologia covers the four last pages in the booklet of 1918, but its general trend will be sufficiently apparent if I quote merely the final sentence:

Were man to regard himself as being an extremely ancient type, distinguished now, and differentiated in the past, purely by the qualities of his mind, and were he to regard existing Primates as misguided and degenerated failures of his ancient stock, I think it would be something gained for the ethical outlook of humanity—and it would be a belief consistent with present knowledge.

The friendship between Professor Wood Jones and myself covers more than half a century; I know his tenderness of heart, his hatred of all forms of cruelty and aggression, his sympathy for the underdog and his partiality for neglected causes; yet these qualities, so beneficent in ordinary life, may be dangerous if permitted to influence scientific judgement.

There was something almost parricidal in the publication of that booklet of 1918 by Wood Jones. For he and I had come together at the London Hospital in the closing years of last century, he as a student of medicine and I as a teacher of anatomy. He was the ablest pupil I ever had. When we first met I was bringing to an end a ten years' period of intensive research into the anatomy of apes and man; I had sacrificed everything for that research. I had collected a much greater array of evidence bearing on the structural relation of man and ape than was at the disposal of either Darwin or Huxley. As is the manner of young

## HYPNOTISM AND SUGGESTION

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suggestion), starting with the voluntary muscles and then spreading to the involuntary muscles controlling the blood vessels, lungs, and gastro-intestinal tract. In my opinion this spread of relaxation takes place in what I call the “post-respiratory pause” and I have found that relaxation can be augmented by voluntary

retardation, for one or two seconds, of the next inspiration. This relaxation will beneficially affect the autonomic nervous system with its central connexions. In the state of relaxation there is response to self-suggestion, the stepping-stone to the will; and along these lines lies the hope of successful therapy.

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ambitious men, I had hoped to find a hole in their armour, but when I had systematized all my evidence I found that it but supported their main contention that man's nearest surviving relatives are the anthropoid apes. Readers will now understand why the bomb thrown by my old pupil in 1918 hit me particularly hard. It was not the dethronement of the anthropoids which hurt me; it was the magisterial way he relegated my ten years of labour to the lumber heap.

Ever since 1918 the tide of evidence has favoured more and more those who regard the anthropoids as man's nearest surviving relatives. Man's chief distinguishing feature—his essential "hallmark"—is his brain. The neurological surgeon, when in need of fresh light on the human brain, finds what he is in search of in the living brains of anthropoid apes; the psychologist in search of the beginnings of human mentality finds them in the mental manifestations of the anthropoids. In the matter of blood groups and in their reactions to disease the great anthropoids make the nearest approaches to man. The hallmark of a close and true relationship between the anthropoids and mankind is found in their identity of placentation; the complex and peculiar method by which the fertilized ovum establishes itself in the womb is identical in both. The nearest thing in all the living world to a new-born babe is an infant anthropoid. All of these resemblances are recognized by Professor Wood Jones, but he holds that man and anthropoid have come by them independently. Nor has he been influenced one whit by the labours and discoveries of geneticists and modern students of heredity; he explains evolutionary change in the same manner as did Lamarck.

#### The Record of the Rocks

All disputes as to the exact evolutionary relationship of man and anthropoid will be finally settled by "the record of the rocks". The fossil anthropoids of South Africa show a medley of anthropoid and human characters; if nothing but their teeth and jaws had been found, these anthropoids would have been given a place in the human line of descent. In face, skull and brain they are anthropoid; their pelvises show both anthropoid and human features. The discovery

of such an intermediate type I regard as conclusive evidence that man and anthropoid belong to the same evolutionary stem. That is not how Professor Wood Jones interprets the mixture; for him the South African fossil forms "... are merely apes that fall short, in some respects, of attaining all the specialisations of their modern representatives." (p. 86)

Most of us see in the fossil anthropoids of South Africa an anthropoid assuming 'humanoid' characters; Wood Jones, on the other hand, sees a humanoid form evolving in an anthropoidal direction. In any case the close relation of man and anthropoid is realized by both of us. In the human face all outward trace of the premaxilla has disappeared; its disappearance, in our author's opinion, is the chief of man's "hallmarks". In the South African anthropoids, as in all primates, the premaxilla maintains its separation from the maxilla, and on this account is excluded by Professor Wood Jones from the human line of descent. He seems to deny the possibility of the snouted face of the anthropoid evolving into the retracted form of the human face.

Lately Dr. L. S. B. Leakey discovered in the lower Miocene deposits of East Africa the skull of an anthropoid ape—the earliest and most complete specimen that has yet come to light. The face is complete and there is attached a large part of the skull. The ape thus discovered was smaller than the chimpanzee. Its most striking characteristic is the degree to which it has retained, in its adult stage, the cranial features of infancy; all the brutal simian features are undeveloped. It is an anthropoid skull but, being devoid of what Professor Wood Jones calls "simian specialisations", has human resemblances. For me, it is an anthropoid ape making approaches in a human direction, but I am sure such would not be Professor Wood Jones' interpretation. For him it will be a scion of the human stem passing in a simian direction. And here I must leave the problem. Whether the reader believes that the general trend of evolution has been to convert the "lower" into the "higher" forms, or whether he believes in the inverted scheme of Professor Wood Jones, in which the "higher" form appears first and the "lower" is evolved from it, he cannot fail to recognize how closely interrelated are the evolutionary histories of Man and Ape.

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## HOW MUCH DO CHILDREN EAT?

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In most of the nutrition surveys that have hitherto been made the diets consumed by families have been measured; the results have given little information about the distribution of food between different members of those families. The total number of children whose diets had been measured before Dr. Widdowson made this survey was not more than a few hundreds, and these studies were made in various countries over a period of some 50 years, during which knowledge of nutrition grew and the attitude to children and their food changed profoundly.

For the present survey, *A study of individual children's diets*,<sup>1</sup> the diets of 435 boys and 481 girls aged 1 to 18 years, as well as those of 112 children in special groups, such as diabetics, were measured. The total number was therefore 1,028, and there were at least 20 boys and 20 girls in each age-group. More than half the children lived in London and only 36 in Ireland, Scotland, Wales and the Channel Islands. The parents of 36% of the children were of the professional class (doctors, lawyers, solicitors, company directors, and university, public-<sup>2</sup> and secondary-school teachers); 52% of the upper working class (accountants, bank clerks, shopkeepers and the like); 12% of the artisan class (fitters, skilled labourers, lorry drivers, factory hands, etc.). Only a small proportion of the children, therefore, belonged to really poor families. Most of the data were collected in the years 1936-38, with a small fraction in the second half of 1935 and the first half of 1939.

The children, or their parents, were supplied with a spring balance, reading to  $\frac{1}{4}$  oz., a sheet of instructions and a set of forms on which to enter results. Proximate principles were calculated from the tables of McCance & Widdowson (1940); vitamins A, B<sub>1</sub> and D from the tables of Fixsen & Roscoe (1938, 1940), Fixsen (1938) and the Medical Research Council (1945). Olliver's (1943) figures were used for calculation of vitamin C, allowance being made for losses in cooking.

Boys and girls of the same age ate about the same amount up to the age of 13 or 14; after this age boys ate more of most foodstuffs, while girls tended to eat rather less, particularly of potatoes. Above the age of 13, boys ate considerably more sweets and chocolates than girls, which is unexpected. Of bread, only one boy ate over 16 oz.<sup>3</sup> per day and only 1 girl over 12 oz. The amounts of certain foods eaten by some of the children are surprising. In one

week a 15-year-old boy and a 14-year-old girl ate, respectively, 28 and 31 oz. of butter; a 17-year-old boy ate 96 oz. of meat (raw weight) and in every age-group of boys over 12 the maximum amount of meat eaten was over 70 oz.; a 14-year-old boy ate 44½ oz. of tinned fruit; one boy of 15 ate 21 oz. of sweets and 32 oz. of chocolate during one week of the holidays. On the other hand none of the children took as much as 2 pints<sup>4</sup> of milk per day and only one boy ate over 12 oz. of potatoes per day. The average boy, in all age-groups but one, got more Calories from sugar than from bread. It is not surprising that 2 or 4 years later some of these children found adaptation to rationing difficult.

The data of the diets were collected for a week; the question arises, how far can the consumption in one particular week be considered representative of the consumption of an individual? Widdowson measured the number of Calories taken by 36 children on each day of a week and thought that there was a "huge" variation; but the maximum day's intake was rarely over 1½ times the minimum of the same child, which is less than might be expected. In 8 cases the diets were measured for 4 consecutive weeks. The variation was much less; the biggest difference between the weeks of highest Calorie intake and lowest Calorie intake was 33%; in 4 cases it was less than 13%. The diets of 8 boys were measured during a week when they were at boarding school and during a week at home; they ate the same number of Calories in the two weeks.

Not even the day-to-day differences would account for the differences between the intakes of individuals of the same age, which certainly are huge. In almost all the age-groups the maximum number of Calories taken by an individual was twice the minimum, and in two age-groups it was 3 times. The variations between the intakes of children of the same height, weight and surface area were about as great as between the intakes of children of the same age. It seems that these great differences can be accounted for only by great differences in the efficiency of individuals as machines.

The number of Calories taken per day in all the age-groups ran very close to estimated requirements, such as those of Cathcart & Murray (1931) and of the National Research Council, USA (1943); but the consumption by boys aged 15 to 18 and by girls aged 10 to 15 was rather less, and consumption by girls of 16 to 18 rather more, than the N.R.C. estimates. Total protein runs so closely parallel to Calories that the intake also must agree fairly well with estimates. The average animal protein was about two-thirds of the total protein, as recommended by Holt & Fales (1921).

No allowance was made for the calcium in tap water, which might amount to about 0.1 g. per day when the water was hard. Boys and girls up to 10 years of age got about 0.8 g. per day; girls over 10 years got 0.6 to 0.7 g. The intake of aneurin fell from about 0.5 mg. per 1,000 Calories at the age of one year to 0.35 mg. at 10 years. The average total ascorbic acid ranged from 41.5 to 79.8 mg. A large proportion was derived from citrus fruits, particularly by girls but not by boys over 15. Carotene, reckoned to have  $\frac{1}{2}$  its nominal vitamin A value, provided under 1,000 i.u. per day and, in most age-groups, considerably less than

<sup>1</sup> [For particulars, see Book Reviews, p. 122.]

<sup>2</sup> [See footnote<sup>2</sup>, p. 52.—Ed.]

<sup>3</sup> [1 ounce = 28 g.—Ed.]

<sup>4</sup> [1 pint = 0.568 l.—Ed.]



was provided by liver. The average preformed vitamin A, derived from foods other than liver, was over 1,000 i.u. in all age-groups, but the only age-groups that averaged over 2,000 i.u. were boys of 15 to 18 years. Most of the children who did not eat liver got between 1,000 and 2,500 i.u. per day. Fat fish supplied a large proportion of the vitamin D; whereas the average intake by children who ate fat fish was over 100 i.u. per day in all age-groups, the average intake by children who did not eat fat fish was less than 90 i.u. per day.

The relation of the consumption of various foods to locality and class was studied. The children of the upper working class got most milk and those of the artisan class least. Only 19% of boys of the professional class took milk at school. Children in S. and S.W. England got most milk and children in N. England least. No consistent differences in consumption of fruit and green vegetables were found. The food was most varied in children of the professional class.

Variations in intake of Calories must be limited by hunger and satiety. Intakes of minerals and vitamins by different individuals naturally vary much more; thus one boy aged 14 years took 30 times as much ascorbic acid as another of the same age. Is there any evidence that these great variations have any relation to the rate of growth or health of the children? The heights and weights of all the children were measured; haemoglobin estimations were made on 189 boys and 200 girls; the teeth of 183 boys and 207 girls were examined with a probe and mirror. As already mentioned, the heights and weights of children seemed to have no relation to their intakes of Calories; they were no more

closely related to intakes of animal protein. The concentration of haemoglobin was not related to the intake of iron. Most of the children had bad teeth; the incidence of dental caries was not related to the amount of calcium in the food. Twin brothers, aged 7, took almost identical amounts of calcium (0.87 g. per day); one had 12 carious teeth and another had none. In the extreme case, children of unemployed parents, whose diet was consistently limited by poverty and not by appetite, were smaller than the average. Children who drank much milk were no better grown than children who drank little. But children who are small for their age are encouraged to drink milk, so that it might be expected that a small child would drink more than the average.

We cannot learn from studies of this kind what happened before and after the week of investigation. It often happens that a child with a poor appetite suddenly becomes a big eater; that a child who disliked some food begins to eat it. The investigations show what the child was eating at the time, but its physical state is the result of what it got in the past. We need some surveys in which individuals are studied over periods of years to see what happens in the end to these big and small eaters.

This investigation has given a wealth of information about the food habits of children. It will be of the greatest value, in years to come, to those who want to know how people lived in the 1930's. Dr. Widdowson has worried out all the information that could be got from the data. It would be interesting to know how much she used mechanical methods of analysis; whether in fact all this information could be extracted by mechanical methods.

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## EUGENICS: INTELLIGENCE AND GENIUS

SIR CYRIL BURT D.Litt. D.Sc. LL.D.

*Professor of Psychology  
University College, London*

These two pamphlets<sup>1</sup> are the third and fourth of the Occasional Papers on Eugenics, issued by the Eugenics Society. They continue the themes taken up by the first two contributors, namely, Dr. Blacker, who reviewed the whole subject of *Eugenics in prospect and retrospect* (1945), and Sir Cyril Burt, who discussed the relations between *Intelligence and fertility* (1946)<sup>2</sup>.

The earliest evidence, showing that there is, in this country at any rate, a negative correlation between the intelligence of children and the size of the families to which they belong, would seem to have been that reported in the surveys of the Psychologist to the London County Council between 1915 and 1921. Both Galton and Karl Pearson had drawn attention to a negative correlation between fertility and social status. But the psychological inquiries carried out among the London school population furnished direct evidence for a negative correlation between fertility and intelligence, and showed that it obtained even within members of the same social class.

Professor Thomson tells us that his interest in the problem dates from about the time when these results were published. He himself then independently noticed a similar correlation while testing school children in Northumberland; and he describes in detail several direct attacks which he has since made on the problem, in conjunction with various collaborators. He ends his discussion with a section on the factors of the mind. Thirty years ago, when factor-analysis first came to the fore, Professor Thomson was one of the severest critics of the existence of a so-called 'general factor', which psychologists of those days identified with what Binet called 'intelligence' and Galton 'natural ability'. It is therefore highly encouraging to find that he now accepts the view that, on the intellectual side, the mind may be assumed to consist both of a general factor and a number of special abilities operating as group factors, and that of these intelligence, defined as an innate, general, cognitive capacity, is by far the most important. He discusses the view that, although intelligence in one form may be declining, there may nevertheless be a possible compensation owing to the "increase in some other form of intelligence"; and eventually rejects it. "I think", he concludes, "that intelligence is much more one thing than such a view would

suggest"; and he believes that the higher level of intelligence "is being steadily lost to Europeans by the selecting power of the differential birthrate."

The pamphlet contains supplementary contributions by Sir Alexander Carr-Saunders, Sir Cyril Burt, and Professor Lionel Penrose. In the main all the contributors appear agreed upon the essential facts, and upon the need for a more direct psychological attack upon the problem.

Professor Terman's pamphlet is a summary of a "twenty-five years' follow-up of a superior group". The full details have been published in a volume recently issued by the Stanford University Press under the title, *The gifted child grows up* (1947). Professor Terman and his colleagues began by carrying out surveys in certain urban areas of California with a view to discovering the children who possessed the highest intelligence quotients. Just over 1,500 boys and girls were identified with quotients ranging from 135 to 200 or a little over. Using Taussig's socio-economic scale, he found that 31% came from class I (professional classes), 50% from class II (semi-professional and business), 12% from class III (skilled workers) and only 7% from classes IV and V (semi-skilled and unskilled labour). From time to time reviews have been made of the same group as it has grown up; and, at the time of the most recent survey (1945), it was possible to secure data for 97% of the original number.

Professor Terman reminds us that, when his investigations were first planned, the current belief, held by most medical men, depicted the so-called precocious child as an abnormal or neurotic creature, "headed, if he survived at all, for post-adolescent stupidity or insanity". The educational corollary was that "the bright child should be protected from intellectual stimulation and any tendency towards early cleverness should be positively discouraged". Even now one still encounters general practitioners and even school medical officers acting on this maxim in the advice they give to parents. Terman emphasizes that the after-histories of his group completely disprove these pessimistic forecasts. As regards physique, health, and mortality, the intelligent child is definitely superior to the average population. The number among whom mental maladjustment has been reported is only 4%; only a fraction over 1% have manifested psychotic disorders. An interesting point brought out by the after-histories is that, even when gifted individuals have succumbed to mental disorder, they generally later show a marked improvement, or even make a complete recovery.

The children of those who are now old enough to have families of their own have also been tested. Their average intelligence quotient is 128—"a regression of somewhat less than half the distance of their parents from the general mean". This, he adds, is in close agreement with Galton's law of filial regression. As regards fertility, he considers it too early for a definite conclusion; but thinks it "very doubtful whether their ultimate fertility will be sufficient to maintain the stock".

The whole inquiry leaves no shadow of a doubt that, by means of suitable tests and other devices, a competent psychologist can nowadays pick out during early childhood those who will prove to be of high intelligence in adult life. This perhaps is most strikingly demonstrated by the adult achievements of the members of Terman's own group. Nearly half the men, and more than half the employed

<sup>1</sup> [Godfrey Thomson, *The trend of national intelligence*.  
Lewis M. Terman, *Psychological approaches to the biography of genius*.  
For particulars, see Book Reviews, p. 122.]

<sup>2</sup> [See *BMB* 1121, 1122 (*Brit. med. Bull.* 1947, 5, 226 & 228).]

# Annotations & News

1311

DR. N. HOWARD-JONES O.B.E.

Last year, Dr. Howard-Jones, who was the founder and first editor of the *British Medical Bulletin*, left the British Council to take up the important post of Director of the Division of Editorial and Information Services of the World Health Organization at Geneva.

Dr. Howard-Jones founded the *Bulletin* in March 1943, and continued as editor for five years. Under his guidance, and in spite of war-time difficulties, the *Bulletin*, from a small journal of a dozen pages consisting mainly of abstracts, rapidly increased in size and importance. By his personality, enthusiasm and editorial skill he enlisted the aid of many eminent contributors and won for the *Bulletin* the high reputation it now holds as a medical review, and which it will be our endeavour to maintain.

Our best wishes, and, we are sure, those of our readers, go with him in his new and wider field of activity.

1312

## BULLETIN MEDICAL BRITANNIQUE

In February of this year appeared the last number (vol. 2, no. 4) of the French edition of this *Bulletin*. We much regret the loss of direct contact with readers of the French language which the discontinuation of this edition entails; but the decision was dictated by financial and other considerations beyond editorial control and we can only hope that our French readers will continue to read the *Bulletin*, in its original English edition.

It would be ungracious in this connexion not to acknowledge our debt to Dr. Pierre Lépine of the Institut Pasteur, Paris, for the time and care he gave to the medical editing of the translation of the *Bulletin Médical Britannique* and we gratefully thank him and his team of translators for their valuable help.

1313

## THE ROYAL SOCIETY

The Royal Society recently announced the names of 25 distinguished scientists elected in 1949 to the Fellowship of the Society. Of those engaged in medical research and allied fields we note with pleasure the following, a number of whom have been contributors to the *British Medical Bulletin*:

FREDERICK CHARLES BAWDEN. Head of the Plant Pathology Department at Rothamsted Experimental Station, Harpenden. Distinguished for his work on plant viruses and virus diseases, he has also made important contributions to the study of virus serology.

FRANCIS WILLIAM ROGERS BRAMBELL. Lloyd Roberts Professor of Zoology, University College of North Wales, Bangor. Distinguished for his experimental studies of processes of reproduction in mammals and of the factors concerned in antenatal mortality.

ERNST BORIS CHAIN. University Demonstrator in Chemical Pathology, Oxford University. Distinguished for his work on enzymes of snake-venom and bacteria, and especially for his researches on penicillin and other antibiotics.

HEDLEY RALPH MARSTON. Chief of Division of Biochemistry and General Nutrition, Commonwealth Council for Scientific and Industrial Research (University of Adelaide, South Australia). Distinguished for his researches on nutrition and wool growth in merino sheep and on trace element deficiency diseases in ruminants.

KENNETH MATHER. Professor of Genetics, University of Birmingham. Distinguished for his contributions to genetics and particularly for his studies of polygenic inheritance.

PETER BRIAN MEDAWAR. Mason Professor of Zoology and Comparative Anatomy, University of Birmingham. Distinguished for his studies of growth processes and of the phenomena associated with tissue transplantation.

WALTER THOMAS JAMES MORGAN. Lister Institute of Preventive Medicine; Reader in Biochemistry in the University of London. Distinguished for his contributions to the chemistry of immunology and blood groups.

NORMAN WINGATE PIRIE. Head of the Biochemical Department, Rothamsted Experimental Station, Harpenden. Distinguished for his research on the chemical and physical properties of plant viruses.

DAVID AYLMER SCOTT. Connaught Laboratories, University of Toronto. Distinguished for his contributions to the chemistry of insulin, heparin, and carbonic anhydrase.

WILSON SMITH. Professor of Bacteriology, University College Hospital Medical School, London. Distinguished for his researches on the virus of influenza and on the pathology of staphylococcal infections.

FRANK GEORGE YOUNG. Professor of Biochemistry, University College, London. Distinguished for his studies of the role of the hormones of the anterior lobe of the pituitary gland in carbohydrate metabolism.

1314

## ADVANCE IN MALARIOLOGY

The opportunity has been taken in the annual report of the London School of Hygiene and Tropical Medicine for the year 1946-47<sup>1</sup> to mark the first centenary of public health legislation by including a historical review of the development of public health in Britain from the Public Health Act of 1848 to the operation of the National Health Service Act in 1948. There are, in addition, the usual reports of the activities of each department of the School during the year.

One of the most exciting searches in tropical medicine was successfully concluded at the School when Professor H. E. Shortt and his colleagues discovered the pre-erythrocytic stages of the malaria parasite, both in animals and man. This work closes a chapter in the history of malaria and opens another which may

<sup>1</sup> [For particulars, see Book Reviews, p. 122.]

## EUGENICS: INTELLIGENCE AND GENIUS

Continued from page 78

women, are engaged in one or other of the professional occupations: this is nine times the proportion so classifiable in the general Californian population. Nearly 90% entered college; nearly 70% are college graduates (90 of the group have either taken, or are now working for, a doctorate). Between them the group has published about 90 books or monographs and about 1,500 articles in scientific or scholarly periodicals; and among their number are included

several professors who have won an international reputation. The average income of the male members of the group is \$4,700. Four are earning as much as \$20,000 to \$40,000 a year.

Professor Terman and his colleagues, as well as those who were generous enough to finance his researches, are to be heartily congratulated on the scientific way in which the enquiries have been carried out, and on the success which they have eventually achieved.

well record great advances in our knowledge of the treatment, prophylaxis and immunology of malaria.

During the war, part of the School building suffered bomb damage, and the report mentions the great hindrance caused by the consequent shortage of accommodation in a building in which additional departments are needed. (Reconstruction of the damaged wing commenced in April 1948.)

The year under review saw a record number of entrants (295) to the regular postgraduate courses. The School maintained a full programme of teaching and was able to accept a large number of ex-Service students for the various courses.

The report has obviously been prepared with great care and is as clean and well ordered as the building from which it emanates. It includes some excellent illustrations by Bernard M. Feilden.

L. T. M.

## 1315

## TWO YEARS OF PHYSIOLOGY, 1945-1947

These two volumes, numbers 9 and 10 of the *Annual Review of Physiology*<sup>1</sup>, give a survey of work in physiology, in most cases covering a period from the summer of 1945 to the summer of 1947, although a few articles deal with the literature of several years. Practically every field of physiology finds a mention in these pages, and there is much of interest to the clinician as well. It is possible to enumerate briefly only a few of the interesting topics discussed. In both volumes there is a chapter on the metabolic functions of the endocrine glands, in which the literature on antithyroid drugs and diabetes receives detailed description. Both volumes also contain a great deal of material on peptic ulcer; it is interesting to reflect that some of the 1945 therapy for this malady is already outmoded.

For the surgeon, there are extensive reviews of the literature on shock, with a special chapter in vol. 10 on its metabolic aspects. He will also be interested in the discussion, in the same volume, of haemostasis, with references to fibrin foam and other new stypic agents, and in the chapter on the visceral functions of the autonomic nervous system (vol. 9) in which there is much bearing on the surgery of the sympathetic system. The neurologist is well served, as there are special articles on cerebral electrical activity and experimental neurosis (vol. 9). Both volumes contain an account of the more important new drugs, the latter including the antihistamine drugs, dibenamine and prisco, the newer analgesics, anaesthetics and fungicides, the rickettsiostatic agent *p*-aminobenzoic acid, the chemotherapeutic agents tried in cancer, BAL, the new insecticides, and the rodenticides such as ANTU. Of interest to the haematologist are the chapters in vol. 10 on cytology of the blood, in which folic acid and the chemotherapy of leukaemias are discussed, and on blood coagulation, a subject much in the news recently.

Students of aviation medicine will find valuable data on anoxia in aviation, the effects of changes in barometric pressure (vol. 10) and other aspects of aviation physiology. A note of horror is struck by the detailed abstract of the report by Major Leo Alexander on the experiments at Dachau on effects of cold (vol. 9). Bacteriologists and geneticists are catered for in a discussion of the genetics of bacteria; the immunologist and specialist in infectious diseases should read the chapter on derivatives of plasma, where early work on gamma globulin is described.

An attempt has been made to impart an international flavour to these annual surveys. Though most of the articles are written by American specialists, six British and three authors from the continent of Europe have also contributed reviews. That more European writers are not represented is clearly not the fault of the editors.

S. S. B. Gilder

<sup>1</sup> [For particulars, see Book Reviews, pages 122 & 123.]

## 1316

## TRICHLORETHYLENE IN CHILDBIRTH

The nineteenth annual report of the Royal College of Obstetricians and Gynaecologists<sup>1</sup> is of special interest in view of the recent discussions, in Parliament and elsewhere, on analgesia

in labour, for it contains (page 59) the report of an investigation made by its Anaesthetics Committee into the use of trichlorethylene as an analgesic in childbirth.

After outlining the scheme of investigation, the report gives details of the types of cases investigated, the efficacy of the analgesia, its effect on the course of labour, on mortality rate, on the foetal pulse rate, and the suitability of trichlorethylene analgesia in the hands of an unsupervised midwife. The apparatus used in all cases was the improved model of the Freedman inhaler.

In the opinion of the Committee trichlorethylene produces adequate analgesia in a high proportion of cases, being superior to gas and air. It can be satisfactorily combined with other analgesics in the more difficult type of labour. A small proportion of mothers become non-co-operative. Evidence of delay due to the analgesic is very slight; there is no sign of increase in the forceps or obstetric interference rate. There did not appear to be any tendency to increased postpartum haemorrhage. A very few cases of cardiac irregularity in the mother were observed, but there was no definite evidence of danger to the mother. The smell is a drawback in some cases and may occasionally cause vomiting.

Although evidence that in certain cases the trichlorethylene was a cause of foetal distress is not very conclusive, one observer considered that it would not be safe in the hands of the unsupervised midwife. Used alone, there was no increase in asphyxia neonatorum, but there was a distinct increase when it was superimposed on pethidine. For use by the unsupervised midwife trained in the method, eight of the observers were of the opinion that it could safely be employed with great benefit to the mother. Two felt that in the hands of midwives without supervision it might be started at an earlier stage and used for longer periods than has commonly been the case in the series under observation, and that further information was necessary; or alternatively, that a slightly weaker mixture of trichlorethylene and air would be more satisfactory. Two observers were definitely against its use without supervision because of its effect on the foetus and production of a non-co-operative state in the mother.

As a result of this investigation, the Council of the College did not consider it possible to recommend the use of trichlorethylene in the Freedman bottle as safe for use by midwives without supervision. Further attempts to produce an apparatus which may fulfil all the requirements for safety will, if successful, enable the Council to reconsider the view it now holds that trichlorethylene is not yet suitable for general use.

L. T. M.

<sup>1</sup> [For particulars, see Book Reviews, p. 123.]

## 1317

PUBLICATIONS OF THE  
WORLD HEALTH ORGANIZATION

The publications of the World Health Organization, which include the *WHO Bulletin* dealing with matters of general interest and the *Chronicle* which records the specific activities of the various WHO Committees, have recently been expanded to include the *International Digest of Health Legislation*. Published at the Palais des Nations, Geneva, no. 1 of vol. 1 contains an introduction which gives the historical background of this publication; its existence is an example of the way in which useful work in the international field is being concentrated under the auspices of the United Nations. In July 1946, the duties and functions of the Office International d'Hygiène Publique were transferred to the World Health Organization, and a part of these duties included the publication of a monthly bulletin. The *Bulletin Mensuel de l'Office d'Hygiène Publique* continued publication until December 1946; it was decided that, while the technical reports which had appeared in this *Bulletin* should be incorporated in the *Bulletin of the World Health Organization*, the section devoted to public health legislation should be the subject of a separate publication. The present journal, the *International Digest of Health Legislation*, is therefore the successor to the first section of the *Bulletin Mensuel*.

The *Digest* is published in the English and French languages, and its ultimate scope will be determined by evidence of its utility; unfortunately no indication is given of the intended

frequency of publication. It is hoped to make it a comprehensive collection of the texts of the most important laws and regulations dealing with public health and related subjects in all countries. The present number contains 24 French orders and decrees, with a smaller number from Australia, Belgium, India, the Union of South Africa, and other countries. This publication should be of great use to those interested in the legislative aspects of public health, and should be of considerable assistance to those charged with the revision of existing statutes or the introduction of new ones.

D. F.

1318

### THE 1948 CHILDREN ACT

The Children Act, 1948<sup>1</sup> is a vital link in the chain of social legislation in Great Britain. Its clauses are based mainly on the recommendations of the Curtis Report (for review see *BMB* 1028). The new Act makes compulsory much of what has previously been done under permissive powers, institutes a measure of control and supervision over children's homes run by voluntary bodies, and, by the appointment of a children's officer to each local authority, co-ordinates the work of various departments in this field.

If a child is deserted or orphaned, or if its parents are unfit or unable to provide proper maintenance, accommodation and upbringing, it is the duty of the local authority to make such provision. This may be done by boarding out in private families or in homes run by voluntary organizations, or by the provision of homes under the direct control of the local authority itself. The Curtis Report revealed the great variations in the standard of children's homes; all these homes are now subject to regular inspection. Permissive power is also given to a local authority to establish hostels for young persons from school-leaving age (15) to 21, near their place of employment, education or training.

The local administration of the provisions of the Act is effected by a specially appointed children's committee to which a "children's officer" shall be directly responsible. This officer plays an important part in the smooth working of the Act, for he is there to provide that personal contact between the State and the individual, the importance of which, though realized, is not always apparent in these bureaucratic days. Appointment of this officer must be approved by the central government and grants can be obtained for training.

This Act came into force simultaneously with the National Health Service Act and already there is evidence that vigorous steps are being taken to implement it.

D. F. A.

<sup>1</sup> [For particulars, see Book Reviews, p. 123.]

1319

### FRENCH MEDICAL SCIENCE: A NEW ENCYCLOPAEDIA

After the First World War, the now well-known *Nouveau traité de médecine* was published under the direction of MM. Roger, Vidal and Tessier. It encompassed French medical thought and teaching and provided an authoritative reference work for students and practitioners; it established a tradition of authority for French-speaking medical men and women everywhere. The advances of medicine in every field during the intervening period have made satisfactory revision of this work impossible. A completely new work was necessary; and as the result of the labour of a distinguished group of French medical scientists a new *Traité de médecine* has been planned and publication is now almost complete.

The responsible committee, A. Lemierre, C. Lenormant, P. Pagniez, P. Savy, N. Fiessinger, L. de Gennes and A. Ravina have had the collaboration of a large number of distinguished medical and surgical colleagues; the work can truly claim to be an authoritative presentation of current French medical thought. The complete work will comprise seventeen large volumes, fifteen of which we have already received. The first four deal with infectious diseases, cancer, avitaminoses, allergic diseases and diseases due to physical agents; the remaining volumes are arranged on a systematic basis. It is the aim of the work to

provide very full information concerning the scientific background of clinical medicine, together with adequate practical information concerning therapy. The firm of Masson & Cie can take great pride in the completion of such an ambitious project; we hope to give a fuller account of this work in a later number of the *British Medical Bulletin*.

D. F.

1320

### ENGLISH FOR SPANISH-SPEAKING DOCTORS AND MEDICAL STUDENTS

Messrs. Longmans, Green & Co., London, have just published a small book designed to help the medical man in Spanish-speaking countries to acquire rapidly a working knowledge of English, with special reference to medical texts. This book, which should fill a long-felt want, consists of 24 short lessons, and when these have been mastered the reader is in possession of a remarkably wide vocabulary of medical terms in daily use. The book is reviewed in Shorter Notices (*BMB* 1406, p. 130) in this issue.

1321

### SOME MEDICAL CONGRESSES

We have received notice of the following meetings:

A Conference on Pneumosilicosis will be held in Sydney, Australia on 28 February 1950. Information regarding this meeting may be obtained from the Dean, School of Public Health and Tropical Medicine, University of Sydney, Australia.

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At the Hotel Statler, New York, the International Congress on Obstetrics and Gynaecology will be held from 14-19 May 1950. The subjects to be discussed will include physiology and pathology of human reproduction, social and economic problems, neoplastic diseases of the female reproductive system, and obstetric and gynaecological procedures. Further information may be had from Dr. Fred L. Adair, 24 West Ohio Street, Chicago 10, Illinois.

1322

### PUBLICATIONS AND REPORTS

The report of the governing body of the Lister Institute for the year 1948<sup>1</sup> records the death of Professor J. McIntosh, a member since 1931, and the retirement of Dr. Muriel Robertson. Details are given on the progress of the bacteriological, immunological, pathological, biochemical, biophysical, physico-chemical, and nutritional studies which were continued during the year, and reports are included on the work done by the Medical Research Council external staff and the Ministry of Health. A list of scientific papers published from the laboratories during the year concludes the report, which appears above the signature of Sir Henry Dale, chairman of the governing body. So much work is recorded in this short report that it is well worth examination, as giving a representative picture of laboratory investigation in Britain today.

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We have received for the first time one of the publications (no. 73, 1948) of the Misión de Estudios de Patología Regional of the University of Buenos Aires. The Misión has for the past 20 years been engaged in field studies in epidemiology and in carrying out laboratory tests and diagnoses for Argentinian doctors. The present publication contains articles on the distribution of Chagas' disease (Dr. Alberto E. Manso Soto), on diagnostic methods in brucellosis (Drs. Alberto E. Manso Soto & José A. Rispoli), on mosquitoes of the city of Buenos Aires (Drs. Alberto E. Manso Soto & Antonio Martínez), and a cytological study of plasmocytes (Dr. Guido A. Loretí). This number is well printed on art paper and illustrated with photographs in monochrome and colour.

<sup>1</sup> [For particulars, see Book Reviews, p. 123.]



Boletim 81 (Estatística, no. 2) of the Faculty of Philosophy, Science and Literature in the University of São Paulo has reached us. This is a detailed biometrical study of 20,852 secondary school children, aged 11–19 years, in São Paulo, carried out by the Professor of Statistics, M. da Silva Rodrigues. There is a full summary in English.

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Under the general title *Conferencias Magistrales*, the Hospital Municipal de Infecciosos, Barcelona, has issued as vol. 8 (1948) of its series of publications the Spanish version of the lectures delivered by Sir Alexander Fleming in May–June 1948, when he visited Barcelona at the invitation of the hospital. Publication has been subsidized by the Instituto de Biología y Sueroterapia, Madrid.

The lectures were delivered in English and simultaneously, re-transmitted in Spanish to audiences in other halls. The subjects chosen were "Some problems of a septic wound," "Lysozyme", and "The use of penicillin". Photographs illustrate the text. The volume also contains an address delivered by Sir Alexander at the inauguration of the hospital's research department.

1323

## NEW JOURNALS

Probably as an aftermath of the war, new journals continue to appear in, one might say, alarming number. Of the score of journals noticed below some are the organs of recently formed associations, as, for example, the *World Medical Association* and the *World Federation for Mental Health*; some pertain to fields of enquiry, now much extended, such as *aviation medicine* and *experimental psychology*; a few are old friends in a new guise, refurbished, enlarged and generally improved.

The International Congress on Mental Health held in London in August 1948 issued a series of twelve bulletins dealing with the progress of its work; these now have a permanent successor in the shape of a bi-monthly *Bulletin of the World Federation for Mental Health* (London, 5s. per annum). The number received gives prominence to articles and news on the work of UNESCO and WHO. Dr. Jaime Torres Bodet, Director-General of UNESCO, contributes an article on current misunderstandings of the statement in the preamble to UNESCO's constitution which reads: "... since wars begin in the minds of men, it is in the minds of men that the defences of peace must be constructed". Dr. Otto Klineberg, of the Department of Social Sciences, UNESCO, writes on "UNESCO Community Studies". The methods to be followed in these studies were discussed at a conference in Paris in January 1949, noticed on another page of the *Bulletin*. The 1950 mental health programme of WHO is outlined in a press release. The text of the Universal Declaration of Human Rights adopted by the United Nations General Assembly is reproduced in full, with part of a covering letter from Dr. Jaime Torres Bodet. Notices of forthcoming international conferences, news of the activities of the World Federation and its member associations, and details of the published Proceedings of the 1948 International Congress make up the remainder of this *Bulletin*, which has condensed a remarkable amount of matter into small compass.

*Journal of Pharmacy and Pharmacology* (London), vol. 1, no. 1, 1949. This is the successor to the *Quarterly Journal of Pharmacy and Pharmacology* and is published monthly, in a new format, by direction of the Council of the Pharmaceutical Society of Great Britain. Several new features have been added: these include a regular review article written by an expert in a particular field of pharmacy or pharmacology, a book-review section, and an enlargement of the section devoted to abstracts of current pharmacological literature. The new journal is more attractively

presented and slightly larger in page size than its predecessor; its publication should be attended by a well-deserved success. The annual subscription is £2.

*The Medical Bookman and Historian*, which commenced publication in 1947 and has already been noticed in these columns (see *BMB* 1219), has now been incorporated in *Medicine Illustrated*, the volumes being numbered in continuation. This new publication, while still devoting some space to the historical aspects of medicine, will include clinical articles, especially those calling for illustrations. It is a beautifully produced journal, lavishly illustrated, and a credit to British printing. The reproduction of the illustrations attains a high standard. The first number contains four clinical articles, some contributions to the history of medicine, and a number of authoritative book reviews.

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There has been a large increase in the volume of work done in the general field of psychology in Great Britain in recent years, and up to the present there has been no journal devoted exclusively to the publication of the results of laboratory and scientifically orientated clinical studies. We have received vol. 1, part 1 of the *Quarterly Journal of Experimental Psychology*, which seeks to remedy this defect. Produced under the auspices of the Experimental Psychology Group—a small private society whose membership is drawn from the teaching and research staffs of British universities and research institutions—it will be open to contributors from any country. The annual subscription is £1 10s. net per volume. The journal is carefully edited and well produced.

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The newly organized Réseau de Lutte Anti-Cancéreuse en Algérie has begun publication of the *Bulletin Algérien de Cancérologie* (Algiers), which is to appear three times a year. Its aim is to assemble all North African writings on cancer and bring about an exchange of ideas among workers in this field. The number received (vol. 1, no. 1, 1948) contains the proceedings of the first and second Algerian conferences on cancer, November and December 1947, and a section of references and abstracts of work on cancer published in French North Africa since 1 January 1940. This section is to be a regular feature and is designed eventually to cover all the French colonies. A third section contains general news and anti-cancer propaganda.

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*Revista de Sanidad de Aeronáutica* (Buenos Aires) appears under the authority of the Argentine Air Ministry. It is to be published quarterly. Vol. 1, no. 1, March 1948, which we have received, contains articles on the importance of perfect masticatory function in flying personnel (Carlos A. Chavarri & Alejandro Ramos Majía); on cardiovascular function at great heights (F. Plas, L. Tabusse, A. Missenard & C. Goujon); on the treatment of burns in aviation medicine (R. Agrelo); an ointment for use in such treatment (Miguel J. Larumbe, Anibal R. Caccia & Luis A. Carbone); and the organization of a laboratory of dental prosthesis (Armando G. Casalins).

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The University of Cochabamba, Bolivia, has begun the issue of *Folia Universitaria*, to be the medium of publication for results of research by the University staff. Vol. 1, no. 1 (December 1947) includes an article on the renal index of acidosis as an expression of renal functional activity; the authors are Dr. Santiago Pi Suñer, professor of normal and pathological physiology, and Srta Elsa Selemé Vargas, assistant in the department of physiological chemistry. Other sections in this number are devoted to archaeology, entomology and botany.

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*Revista Brasileira de Cancerologia* (Rio de Janeiro) is the official quarterly journal of the Serviço Nacional de Câncer, instituted in 1941; publication begins with the number we have just received (vol. 1, no. 1, September 1947). Its aims are to make the work of the S.N.C. known to all practitioners in Brazil and to enlist their interest in the problems of cancerology, with special emphasis on the matter of early diagnosis. The present number includes articles on the time factor in roentgenotherapy (Dr. A. Ozório de Almeida), present-day standards in the treatment of cancer of the breast (Dr. Antonio Prudente), cancer and pregnancy (Dr. Mário Kroeff), and radiotherapy of cancer of the lip and tongue

(Dr. Nelson Carvalho). Case-reports, shorter articles, abstracts from current periodicals, and a report of a meeting of the Sociedade Brasileira de Cancerologia make up the rest of the number, which is illustrated with photographs. Two of the main articles have summaries in English.

A new journal from Bogota is the monthly *Boletín del Instituto Nacional de Radium*. The editors intend that it shall consist of two parts, a clinical section presenting notable cases seen by the Institute, and a section of original contributions and reports of lectures. In vol. 1, nos. 1 and 2, 1948, cases are reported of cyst-adenoma of the breast simulating sarcoma, molluscum pendulum, and cancer of the larynx treated surgically; two original articles (both by Dr. Luis M. Borrero) deal with general considerations on x- and γ-rays, and general methods and biological bases of radiotherapy; others deal with naso-pharyngo-sinusal cancer (Dr. Roberto Restrepo), and tumours in general and classification of tumours (Dr. Alfonso Méndez L.). The *Boletín* is well printed and adequately illustrated with drawings and photographs.

Also from Bogota is *Revista del Hospital de la Samaritana*, of which we have received vol. 1, no. 2, October 1948. This new quarterly is the organ both of the Hospital and of the Instituto de Higiene Social de Cundinamarca. All contributions to this number are by members of the hospital staff, and deal with latent syphilis (Dr. Jorge Cavelier), syphilis congenita tarda (Dr. E. Quintero Cañizares), treatment of burns (Dr. G. Nieto Cano), duodenal intubation (Dr. E. Peña Alvarado), the Mazzini microscopic serum flocculation reaction (Dr. F. Cortés Boshell), liver extract (Dr. G. Escallón Caycedo), and demerol (Dr. A. Felfie). The editorial makes proposals for control of laboratories which carry out serum reaction tests for syphilis.

*Boletín del Hospital Militar* (Havana), of which we have received vol. 1, no. 1, July 1948, is a new quarterly consisting entirely of selected items from the weekly clinical and scientific meetings of the staffs of the Hospital Militar "Dr. Aristides Agramonte" and of the Clínica Central "Dr. Carlos J. Finlay". In size and format it resembles the well-known *Proceedings of the Staff Meetings of the Mayo Clinic*. It is illustrated with photographs, and some of the articles are accompanied by summaries in the original language.

The conditions of war made it impossible for Les Sociétés d'Obstétrique et de Gynécologie de France to publish their Bulletin from 1940 until January 1949. We have received vol. 1, no. 1 of their new publication, *Bulletin de l'Association des Gynécologues et Obstétriciens de Langue Française*. Published in Paris, five numbers will appear annually; as the name implies, the new publication has enlarged its scope and its pages will record the activities of the societies which together compose L'Association des Obstétriciens et Gynécologues de langue française, la Société Royale Belge and La Société de la Suisse Romande. The present issue reports the proceedings of a considerable number of the meetings of the member societies; there is in addition a large section devoted to abstracts of current literature of the specialties.

*La Chronique Médicale de la Bigorre* (Tarbes) is a new venture—a journal of professional news emanating from the provinces but directed not only to local doctors but to colleagues all over France and even to those outside that country, with the hope of establishing contact and exchange of views between widely separated medical men. While this seems a worthy object, we cannot help feeling it is a little ambitious. We recognize the value of optimistic idealism and the fact that great things may grow from small beginnings, but, in its first three numbers (nos. 1, 2 and 3 for January, February and March 1948 respectively), this slight journal has a light-bearded and somewhat irresponsible air strongly reminiscent of an English medical school magazine—excellent in its place, but hardly calculated to enhance serious professional relations on the international plane.

The first two numbers (vol. 1, fascicles 1 and 2, March and July 1948) have reached us of a new Italian quarterly of general medicine entitled *L'Arcispedale S. Anna di Ferrara*. The March number opens with an outline account by Professor Galavotti of the administrative history of the hospital since its foundation by Papal decree in 1440. He sets out the stages by which it

attained the title "Arcispedale", as late as the second half of the 18th century. Professor Galavotti hopes to deal with the medical history of the hospital in a later article. Other articles cover a wide field of general medicine, pathology and minor surgery. By an editorial directive, all articles have summaries in Italian, French, English and German.

*Minerva Pediatrica* (Turin) is a new Italian monthly specialist journal, uniform in style with the well-known *Minerva Medica*. It combines three journals formerly published by Edizioni Minerva Medica: *Medicina Italiana*, *Pediatria del Medico Pratico*, and *Policlinico Infantile*. Vol. 1, no. 1 (January 1949) contains an address on inoculation against tuberculosis, by Professor G. de Toni, and articles on the relative concentration of penicillin in blood and cerebro-spinal fluid (Dr. M. Gomirato Sandrucci), on a method of making megacaryocyte counts in infants (Drs. E. Grasso & C. Sticca), applications of radioactive isotopes (Dr. C. Lombroso), Hand-Schüller-Christian's disease (Dr. F. Toscano), and the toxicity of streptomycin (Dr. C. Fuà). Most of the longer articles have summaries in the original language. A short section of abstracts from non-Italian periodicals is included.

Vol. 1, no. 1 (May-June 1948) of the bimonthly *Revista del Instituto Mexicano para el Estudio y Tratamiento de los Tumores* contains articles on carcinoma of the prostate (Drs. C. P. Mathe & Carlos E. Ardila), on biopsy (Dr. Alvin G. Foord), on clinical aspects of mammary cancer (Dr. G. Vázquez Arroyo), on the role of histopathology in the anti-cancer campaign (Dr. J. Sánchez Márquez), and on cancer investigation in France under the guidance of the Institut National d'Higiène (Dr. P. Denoix). Most of the articles have summaries, in the original language.

We have received vol. 1, no. 1 (November 1948) of the *Pakistan Medical Journal* (Karachi)—apparently the only regular medical publication in Pakistan at present. The auspices under which it is being published are not entirely clear, but it is apparently getting a good deal of financial support from the Asian Laboratories Limited, manufacturers of pharmaceutical products in Karachi. The main articles are not of a very high scientific standard, and contain little of significance; this is perhaps because they are largely reports of medical addresses rather than the result of clinical study or research work. Typographical errors abound, and the journal is not well produced. A medical journal of high standard would be of enormous value to Pakistan, and it may be that with further experience this one will fill the need. The editorial policy advocates the teaching of medicine in Urdu, and the preservation of the Unani system of medicine fused with modern scientific knowledge. The present journal, however, is entirely in English. The foreign rate of subscription is £1 6s. per annum.

*Gazeta Médica Portuguesa* (Lisbon) is a new quarterly designed on a comprehensive scale. The present number, of 258 pages, (vol. 1, no. 1, 1948) is made up of 19 sections: medicine, surgery, pathological anatomy, cardio-angiology, dermatovenereology, gastro-enterology, haematology, hygiene, neurology and psychiatry, paediatrics and puericulture, phthisiology, stomatology, obstetrics and gynaecology, opthalmology, oto-rhino-laryngology, orthopaedics and traumatology, urology, clinical analyses, and nursing. Sections on pharmacology and therapeutics, radiology, and legal medicine are announced for inclusion in the next number. The editors state that each section is regarded as an independent review, which may be bound in five-yearly volumes; accordingly, there is a sectional pagination as well as one for the whole number. Most sections include reviews of selected articles in their own field. In addition, a separate section of reviews is to be included in future numbers. The journal is illustrated with photographs and drawings, and nearly all the original articles have summaries in English and French.

Vol. 1, nos. 2 and 3 (March and June 1948) of *Archivos del Colegio Médico de El Salvador* (San Salvador) have reached us. The Colegio has now taken a leading place in a federation of Salvadorean medical societies (Federación Médica Salvadoreña), formed in May 1948. The *Archivos* are published quarterly. Most of the original articles are followed by a summary in Spanish. No. 3 includes details of a social security scheme drawn up by a government-appointed commission, covering

medical and dental services and maternity benefits as well as provision for unemployment, etc. Abstracts from American and British periodicals form a separate section.

From Spain we have received *Ciencias Médicas Hispano-Americanas* (Madrid, vol. 1, no. 1, 1948). This new journal is to be issued annually by Editorial Médica "Made". The first number contains interesting articles on a variety of subjects, including an account of the Spanish influenza epidemic during the winter 1946-47 (Dr. M. Bañuelos), a clinical history of a case of synovial osteochondrosis (Dr. Otero Sánchez), physio-pathological observations on arteriovenous aneurisms (Professor P. Piulachs), and a study of the problem of arseno-resistants in syphilis by Dr. Sáinz de Aja. In addition to original articles, the journal contains a section on medicine and art, obituary notices, notices of meetings, and news and abstract sections.

The World Medical Association, formed in 1946, has begun publication of a quarterly *World Medical Association Bulletin* (Mount Morris, Illinois). Contributions are published in English, French, and Spanish; the more important ones appear in all three languages, printed in parallel columns. Vol. 1, no. 1 (April 1949) is mainly concerned with the ethical basis of medicine. A statement on "War Crimes and Medicine" discusses measures for the moral rehabilitation of the German medical profession in world opinion; in the same article a revised form of the Hippocratic oath is proposed for adoption by universities and licensing authorities. J. Voncken in another article suggests that such an oath would best be administered under the authority of the Permanent International Court of Justice, which would have the power to prosecute and punish perjury. Dr. T. C. Routley, General Secretary of the Canadian Medical Association, writes on the aims and objects of the World Medical Association. In a preliminary report on social security adopted by the General Assembly of the World Medical Association, twelve principles are enunciated which should govern the provisions of medical care where this forms part of a scheme of social security. The number closes with a general report on the second annual meeting of the General Assembly in September 1948, and an announcement of the next meeting of the General Assembly, to be held in London in October 1949.

A new specialist publication from Venezuela is *Archivos Venezolanos de Patología Tropical y Parasitología Médica* (Caracas), of which we have received vol. 1, no. 1, January 1948. This journal is edited in the Department of Tropical Pathology of the Universidad Central de Venezuela, and is published with the collaboration of the Fundación Biogen, Caracas. The present number consists entirely of ten original articles; these include contributions on the first determination of *Trypanosoma rangeli* in the human organism from a culture of peripheral blood (Dr. Félix Piñano C. and others), experimentally produced unisexual infection by *Schistosoma mansoni* (Dr. Félix Piñano C.), treatment of bilharziasis with preparations of antimony (Professor Martín Mayer), and synthetic anti-malarial drugs (Drs. S. Holz & M. Granier). The other articles consist of studies of tropical disease in Venezuela. Summaries, usually in English as well as in Spanish, accompany all articles; most are of adequate length, but a few should be much fuller in order to be worth while. The journal is illustrated with drawings, graphs and photographs; unfortunately the poor quality of paper used makes it difficult to assess the value of the latter.

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## JOURNALS NEWLY RECEIVED

The *British Journal of Urology* (London), vol. 21, no. 1, March 1949, appears in an attractive new format and under new editorial direction. The number and length of main articles has been increased; these are profusely illustrated, and the quality of the illustrations, x-ray reproductions, and diagrams is very high. There is also a comprehensive "Index to Current Urological Literature" which should prove extremely useful. The journal maintains in every way its former high standards, and is a publication worthy of representing the British Association of Uro-

logical Surgeons. The annual subscription is £2 2s. per annum; the journal appears quarterly.

*Parasitology* (London) has long been a standard publication in its field, and its presentation and reproductions are above reproach. We have recently received no. 1-2 of vol. 39, and this, with subsequent numbers, will be available in the Medical Department library of the British Council. Cambridge University Press are the publishers of this journal, and its subscription rate is £2 15s. per volume.

We have recently received vol. 26, parts 1-6, 1948 and vol. 27, part 1, 1949 of the *Australian Journal of Experimental Biology and Medical Science*. This bimonthly journal, published by the University of Adelaide and managed by the Medical Sciences Club of South Australia, has, for more than twenty years, been devoted to the prompt publication of the results of Australian medical research. Its field of interest includes the whole range of the medical sciences, including zoology, genetics, and animal and plant physiology. It is restricted almost entirely to Australian work, and is well produced and carefully edited.

The *Patna Journal of Medicine* is an English language Indian medical publication issued quarterly and chiefly devoted to problems of public health and social medicine as well as to general clinical topics. The present issue (vol. 22, no. 1-2, January-April 1948) displays great interest in the National Health Service of Great Britain and gives a considerable amount of space to it. With the present changes in India there will be an expanding field of useful activity for such journals.

*Revista de la Asociación Argentina de Venerología y Profilaxis Social* (Buenos Aires) is now in its 13th year of publication. This journal publishes, mainly, articles specially written for it, or the text of lectures and discourses delivered at the meetings of the Association. The first number received here was vol. 11, no. 19, 1947; this opens with an article inaugurating a series by Dr. Alejandro Dicosky which studies the social implications of venereal diseases. Summaries of discourses delivered by delegates at meetings of the Association are also included, as well as the text of lectures given at its 34th scientific session in May 1947. In addition, the journal contains a section giving news of appointments and retirements and a general news section.

*Anais do Instituto Pinheiros* (São Paulo), vol. 11, no. 22, July 1948, contains articles on nitroglycerine (Dr. V. Van der Reis), salmonellosis of guinea-pigs (Dr. Arnaldo A. Pereira and others), and on South American blastomycosis (Dr. C. S. Lacaz); summarized proceedings of the meetings of the Council of the Institute, and a short section of book reviews. The journal is illustrated with photographs, charts, etc., and the table of contents appears in English as well as in Portuguese.

An exchange has been arranged with *Revista de Medicina e Cirurgia de São Paulo*, the monthly journal of the medical and surgical society of São Paulo. The first two numbers received (vol. 8, nos. 1 and 2, January and February 1948) contain articles on the statistics of the acute abdomen in gynaecology (Dr. Hilda Paonessa), the problem of exposure of recurrent nerves in thyroidectomy (Dr. S. Hermeto, jr.), and the milk trade in São Paulo from the point of view of social hygiene (Dr. F. Pompêo do Amaral). Brief notes of the meetings of the Sociedade de Medicina e Cirurgia de São Paulo appear in the February number.

A special number of *Archivos de la Sociedad de Cirujanos de Hospital* (Santiago), 1948, is devoted to the proceedings of the ninth Chilean congress of surgery held in Valdivia in December 1947. Symposia on blood proteins in surgery, osteomyelitis, and rectal prolapse, and 22 papers on miscellaneous subjects, are included. All contributions are fully reported, in the usual style of this journal; the majority are illustrated, with summaries in the original language and bibliographies.

*Revista de Medicina y Alimentación* (Santiago) is published quarterly by a group of scientists drawn from Argentina, Chile and Peru. Vol. 8, no. 1-3 (January-April-June 1948) contains

an account of a clinical trial of streptomycin with para-aminosalicylic acid in a case of pulmonary tuberculosis (Dr. Arturo Rodríguez R.), and six studies in nutrition, concerning proteins in nutrition (Dr. Julio V. Santa María), consumption of fish in Santiago (C. Leyton G.), administration of amino-acids to premature infants (Dr. E. Zarzar Miquel), prevention of dental caries in children by the use of bone salts (Dr. A. Fernández Correa & Sr. Carlos Doer Z.), concentrated vegetable soup in infant feeding (Drs. A. López Matas & F. Mardones Restat), and the protein quota in the diet of a section of the population in Santiago (Dr. R. Miranda and others). The longer articles have summaries in Spanish.

Published in the same cover with the *Revista* is the *Boletín de la Sociedad de Biología de Santiago de Chile* vol. 6, no. 1, October 1948) containing reports, many of which are in full, of papers read before the society.

*Boletín de Sanidad y Asistencia Pública* (Ciudad Trujillo), of which we have received vol. 4, nos. 1 and 2, January-March and May-June 1948, is the quarterly journal of the Ministry of Health and Public Assistance of the Dominican Republic. Each number contains a full summary of new national legislation in these fields. In addition, no. 1 contains an article on the contribution of British medicine to the progress of world medicine, by Dr. J. Jaramillo-Aranga, former Colombian Ambassador in London, and no. 2 an article on the World Health Organization, by Dr. H. Van Z. Hyde, and another by Dr. Corwin Hinshaw on the present state of streptomycin investigation; this latter is reproduced from the *Boletín de la Oficina Sanitaria Panamericana*.

*La Parfumerie Moderne* (Lyons) is a bimonthly technical journal of the perfumery industry, which publishes articles of a scientific nature, many of them having a medical bias. The number for June 1947 (year 39, no. 4) is a special number on the practice of cosmeticology. There are six main articles on such subjects as the use of protein hydrolysates in nutrition of the skin, and the new American emulsifiers derived from sorbitol. The number also includes reports on two congresses (the Congress of Cosmeticology, held in Paris in June 1947, at which a paper was read by Dr. J. M. L. Burtenshaw, then Scientific Adviser to the British Council in Paris, and the Congress of Pure and Applied Chemistry, held in London in July of the same year); one book review (of *Modern cosmeticology*, by R. G. Harry, London, 1946); and an article on cosmeticology for summer holidays (formulae of the preparations recommended are given). In addition, three and a half pages are devoted to a critical analysis of vol. 1, no. 4 of the French edition of *BMB* (corresponding to vol. 3, no. 7-8, "Skin and its Disorders", of the English edition), the greatest attention being given, as would naturally be expected, to the article by Berry on ointment bases (*BMB* 737).

*Zeitschrift für Hygienische Zoologie und Schädlingsbekämpfung*, now in its 37th year, deals with parasitology and with pest destruction in its widest sense. It aims to bridge the gap between theory and practice and to make available the information required to apply the newer methods of pest destruction. The journal, published by Duncker & Humblot of Berlin and Munich, now resumes publication, having been suspended in September 1944. No. 1, January 1949, largely concerns itself with communal methods of rat destruction, malaria control, and the uses of DDT.

An exchange has been arranged with the well-known Italian bimonthly journal, *Lotta contro la Tuberculosis* (Rome), the organ of the Federazione Italiana per la Lotta contro la Tuberculosis. We have received nos. 1-3 of vol. 18 (January-February to May-June, 1948). Nos. 1 and 2 include four articles on tuberculosis in Italy in relation to the war and the post-war period; these deal with the causes, frequency, mode of onset and course of pulmonary tuberculosis in Italy during and since the war, with special reference to Venetia Tridentina, by Professor Vittorio Lubich; the course of pulmonary tuberculosis during and since the war, with special reference to specific peritoneal, gastric and intestinal complications, by Dr. F. Enrico; pulmonary tuberculosis in Bolzano during the war and the post-war period, by Professor Mario Martinelli; and the mortality from tuberculosis in Italy during and after the war, by Giovanni L'Ellore and Elio Caranti. The first three papers were presented at the second

scientific convention of the Associazione Regionale Tridentina contro la Tuberculosis, held at Arco in September 1947; a full summary of its other proceedings appears in the March-April number. No. 3 (May-June) contains the programme and six papers for the seventh national anti-tuberculosis conference, to be held at Bari in October 1948. Owing no doubt to present-day difficulties, these numbers bear a date considerably earlier than their actual date of issue—e.g. the March-April number finished printing at the end of August 1948.

*La Medicina del Lavoro* (Milan). We have received for the first time a number (vol. 39, no. 1, January 1948) of this monthly periodical. The original articles included deal with a fluorographic survey of silicosis and tuberculosis among insured workers in North Italian foundries and steel works (Professor Enrico C. Vigliani, Drs. Luigi Parmeggiani & Ennio Zanetti); a radiological study of the hilar shadows of 1,026 sufferers from silicosis (Dr. Ennio Zanetti); a histological study of the central nervous system in a case of acute CO intoxication (Dr. Carlo Ceresa); and a study of symptoms of chronic intoxication in workers engaged in nitrobenzene and dinitrobenzene production (Dr. Cornelio Bellesini). Each article is followed by a summary, which in most cases appears in English also. Reviews of books and selected articles, and a section of notes and news, are also included. The journal is well produced, its appearance showing little trace of repercussions from post-war difficulties or shortages.

From Mexico comes the *Anales de la Sociedad Mexicana de Oftalmología*, 5th series, vol. 22, no. 3, July-September 1948. Articles in this number deal with Romberg's disease (T. Agundis, jr.), epithelial oedema of the cornea (David G. Cogan), fractures of the orbit (Raúl A. Chavira), and the thesauruses (E. González Aguilar). Illustrations and very brief English summaries are included.

We have received vol. 7, 1947-48, of *A Criança Portuguesa*, bulletin of the Instituto António Aurélio da Costa Ferreira, Lisbon, a government-aided foundation for the study, practice and teaching of child psychiatry. The institute admits backward and problem children of all categories for observation, and advises on their future treatment or training in homes, special schools, out-patient clinics, etc.; it also provides out-patient consultations and a domiciliary visiting service, and courses of instruction for teachers and social workers. During the period 1942-1947, 2,149 children were seen; in December 1947 more than half this number were still awaiting vacancies in suitable institutions.

Vol. 7 of *A Criança Portuguesa*, which is published complete (468 pages), contains 12 original articles, a section devoted to reports of congresses, a report on the work of the institute and a section of book reviews. Dr. V. M. Santana Carlos, director of the Albergaria de Lisboa, a training school for backward children, contributes an account (160 pages) of training institutions and after-care for mentally deficient children in Belgium, Denmark, Spain, Holland, England, Italy, Sweden and Switzerland. The material for this was gathered during a three months' study tour. Other articles which illustrate the international outlook of this bulletin are: "Modern Trends in Child Guidance in the United States" (Mlle. C. Arnou, in French), and "The Care of Mentally Backward Children in Sweden" (Torsten Ramer, in German). All articles have full summaries in English, and in French, unless themselves written in French. The bulletin is illustrated with photographs, unfortunately not very well reproduced; apart from this it is well printed, and its unusually handy size (23 x 16 cm.) is a very agreeable feature.

The monthly *Boletín Cultural e Informativo* (Madrid) of the Consejo General de Colegios Médicos de España, of which we have received vol. 5, nos. 23 and 24 (October and November 1948) is made up of a number of regular features: each number includes one article on medicine, surgery, therapeutics, a special subject, literary aspects of medicine, sickness insurance, and photographs of some particular institution, as well as general medical news, and changes of address of practitioners in Spain. An interesting feature is a sheet of abstracts from Spanish periodicals, printed on stiff paper in semi-perforated "boxes" measuring 12 x 7 cm., designed for filing in a card cabinet.



The following journals have also been received :

### British

- Mental Health* (London), vol. 8, no. 3, 1949  
*Mouth Mirror. The Journal of the Incorporated Dental Society* (London), vol. 22, no. 174 & 175, 1948  
*North Wing. The Magazine of the Sheffield Medical and Dental Schools* (Sheffield), summer 1948  
*Prescriber* (Edinburgh), vol. 42, no. 1, 1948  
*Rehabilitation* (London), no. 1, 1948

### European

- Acta Anatomica* (Basel), vol. 3, no. 3-4, 1947  
*Acta Medica* (Izmir), vol. 1, no. 2, 1948  
*Annales Médicales. Revue de l'Union des Médecins Bulgares* (Sofia), year 40, no. 1, 1948  
*L'Année Biologique* (Paris), vol. 24, no. 1, 1948  
*Biologické Listy* (Prague), year 28, no. 3, 1947  
*Casopis Lékařů Českých* (Prague), year 86, no. 52, 1948  
*Geneeskundige Gids. Wetenschappelijk Tijdschrift voor Geneeskunst en Volksgezondheid* (The Hague), year 27, no. 5, 1948  
*Index de Pharmacie. Tables Alphabétiques et Systématiques* (Paris), vol. 1, 1946  
*Información Médico Quirúrgica* (Saragossa), no. 1, 1949  
*Informations Médicales de la S.N.C.F.* (Paris), no. 15, 1947  
*Le Médecin Belge. Bulletin Officiel de la Fédération Médicale Belge. (Het Belgisch Geneesherenblad. Officieel Blad van het Algemeen Belgisch Geneesherenverbond)* (Brussels), year 45, no. 4, 1949

- La Pediatria del Medico Pratico* (Turin), vol. 22, no. 11-12, 1947  
*Revue Belge de Pathologie et de Médecine Expérimentale* (Brussels), vol. 18, no. 1, 1947  
*Revue Mensuelle: Médicale, Scientifique, Sociale* (Teheran), no. 7, 1947  
*Roczniki Uniwersytetu Marii Curie-Skłodowskiej* (Lublin), vol. 1, section D, 1946  
*Sborník Lékařský. Oficiální Publikáční Organ Lékařské Fakulty u Praze* (Prague), vol. 49, no. 10, 1947  
*Synthèse de Sémiologie et Thérapeutique. Documentation Synthétique de Pratique Médicale* (Paris), vol. 1, no. 1, 1948

### South American

- Alergia* (Buenos Aires), vol. 1, no. 2, 1947  
*Arquivos da Assistência a Psicopatas do Estado de São Paulo* (São Paulo), vol. 10-11, no. 1, 1945-1946  
*Arquivos de Biologia* (São Paulo), year 31, no. 281 & 282, 1947  
*Arquivos Brasileiros de Oftalmologia* (São Paulo), vol. 10, no. 3, 1947  
*Arquivos do Instituto Brasileiro para Investigação da Tuberculose* (Bahia), vol. 6, 1943-1945  
*Arquivos da Sociedade de Medicina Legal e Criminologia de S. Paulo* (São Paulo), vol. 17, no. 1, 2, 3, 1946  
*Boletín de la Academia Peruana de Cirugía* (Lima), year 2, no. 15, 1948  
*Boletín de Antropología Judicial del Tolima* (Ibague, Colombia), year 1, no. 2, 1947  
*Boletín de la Asociación Médica de Puerto Rico* (Santurce, Porto Rico), vol. 39, no. 11, 1947  
*Boletín del Consejo Nacional de Tuberculosis* (Havana), January 1948  
*El Boletín Médico Mexicano* (Mexico D.F.), vol. 3, no. 1, 1947

- Boletín de la Sociedad Cubana de Dermatología y Sifilografía* (Havana), vol. 4, no. 4, 1947  
*Boletín de la Sociedad de Obstetricia y Ginecología de Buenos Aires* (Buenos Aires), vol. 25, no. 5, 1946  
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## Historical Notes

1325

### EDINBURGH AND MENTAL SCIENCE

Edinburgh's contributions to surgery and medicine are well known. Not so familiar, yet significant if less considerable, is her part in psychiatry.

Lectures in mental diseases have been given in Edinburgh since 1823.

It is doubtful if the subject has been taught for such a long unbroken period in any other medical school in the world. Although Esquirol was the first in 1817 to give regular lectures in Paris, his lectures came to an end about eight years afterwards. It may be said truly that the Edinburgh Medical School and not that of Paris inherits his tradition.<sup>1</sup>

Indeed, earlier than 1823, when the Royal Asylum was built at Morningside, Edinburgh (under an Act<sup>2</sup> which also covered the use of British fisheries!), instruction in mental diseases to students was considered, as well as the care of inmates. Subscriptions for this asylum came from all over the world—Madras, for instance, contributed £1,000.<sup>3</sup>

The first course of lectures in mental diseases was delivered by Sir Alexander Morison, to whom the idea of such instruction arose from his visit to Paris. The university authorities at Edinburgh were not sympathetic to the suggestion of founding a chair of psychiatry—Professor Hope, discoverer of the maximum density of water, saying that the university would be having a lectureship in dropsy established by some gouty old gentleman or accepting a lectureship in pleurisy, if they were not careful—so Morison delivered the lectures privately. His first audience numbered six. He continued these annual lectures until 1852<sup>4</sup> and published several books on psychiatric subjects.<sup>5</sup>

In 1859 Thomas Laycock (1812-1876), Professor of Medicine, introduced a summer course of lectures on medical psychology; they were delivered to "a limited but thoughtful class of students." Laycock was "a voluminous writer, a philosophical thinker, and a man of immense erudition."<sup>6</sup> His doctrine of the reflex functions of the brain he first began<sup>7</sup> to formulate when at York; his last paper on the subject appeared in the *Journal of Mental Science*

shortly before his death in 1876.<sup>8</sup> His treatise, *Mind and brain* (Edinburgh, 1860), published when he was Professor in Edinburgh, prepared the way for the study of unconscious cerebration, to which he afterwards chiefly devoted himself; the phenomena which he described only received full recognition in connexion with nervous cases observed in the First World War. He also published *Nervous diseases of women* (London, 1840).<sup>9</sup>

The first Lecturer in Mental Diseases at Edinburgh University was Sir Thomas Smith Clouston (1840-1915), whose *Clinical lectures on mental diseases* (London, 1883) was a standard textbook.<sup>10</sup> On the scientific side he advocated a somatic classification of insanity. He was particularly concerned for "the establishment of an atmosphere in which no more stigma should attach in the public mind to the incidence of an attack of mania than to an attack of measles, and to that end he set himself to instil his views into the medical mind, and through it to influence the public. Hence the popular strain in which his well-known textbook was written, and hence his efforts to adapt asylums and their administration to medical conceptions of the treatment of disease."<sup>11</sup> To this end, too, Clouston devoted the latter part of his life to public lecturing and wrote two books for the layman, *The hygiene of the mind* (London, 1906) and *Unsoundness of mind* (London, 1911). He "foreshadowed the present-day vogue for popular expositions of psychology."<sup>12</sup> Nor must one omit to mention that he was the first to advocate training for what were then called "asylum attendants." This he suggested in an address to the Royal Medico-Psychological Association in 1876.<sup>13</sup> Later, the Association established the first national examination for nurses in the mental field.

Sir John Batty Tuke (1835-1913), who was appointed lecturer in psychiatry in the School of Medicine of the Royal Colleges (Surgeons' Hall), Edinburgh, in 1874, was the first to describe what are now known as senile plaques, and the pigmentary deposits in the vessels and cells of the cerebral cortex. "He was a man who allowed no liberties to be taken with him, was a trifle irritable at times, and always kept up the dignity of his profession." He influenced modern psychiatry,<sup>14</sup> and was one of the first to abolish mechanical restraint.<sup>15</sup>

Another pioneer in humane treatment was also associated with Edinburgh, having received his medical education there. He was Dr. Alexander Francis Browne, who introduced at the Crichton Royal as early as 1844 theatricals and concerts and a monthly



magazine, all produced by the patients. Dr. Browne's son, Sir James Crichton-Browne, was also educated at the Edinburgh medical school; he established at Wakefield the first research laboratory in neuropathology in the United Kingdom and was one of the first to stress the importance of early recognition and treatment of breakdown.<sup>10</sup>

Robert Whytt (1714-1766) in 1751 published an *Essay on the vital and other involuntary motions of animals* (Edinburgh), which contains a record of numerous experiments dealing especially with reflex movements. He also was the first to give a clear description of tuberculous meningitis,<sup>11</sup> and wrote *Observations on the nature, causes and cure of those disorders which are commonly called nervous, hypochondriac, or hysteric* (Edinburgh, 1764). Among other teachers at the Edinburgh Medical School who made notable contributions to knowledge in the mental field were the brilliant Alexander Monro (*secundus*) (1733-1817), who succeeded his father in the Chair of Anatomy in 1758, and described the foramen of Monro and published original observations on the "bursae mucosae" and on the lymphatics; and Sir Charles Bell (1774-1842), whose work on the anatomy of the nervous system is well known, who described Bell's palsy,<sup>12</sup> and held the Chair of Surgery from 1835 until his death in 1842.

Laurence Dopson

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1326

### ST. PATRICK'S HOSPITAL, DUBLIN

This Bi-Centenary Record<sup>1</sup> of Swift's "house for fools and mad" gives a factual account of the development of St. Patrick's Hospital, Dublin, from its charter of 1746 and the admission of its first ten patients in 1757, to its present state as a modern psychiatric hospital. The Record was less designed to stand alone than to serve as an annotated catalogue of the exhibition held in the Royal College of Physicians in Ireland, in connexion with the Bi-Centenary and the Dublin meeting of the Royal Medico-Psychological Association, in May 1948. It can therefore hardly be judged as a book; yet it has the more than passing interest which must attach to everything associated with Jonathan Swift, the greatest satirist who has written in English, and Dean of St. Patrick's Cathedral, Dublin, from 1713 until his death in 1745. That his physical tragedy might have been alleviated and the horror of his last years avoided, had he lived in this century, is some indication of medical progress in the last 200 years. His lifelong dread of madness, and his final obliteration in one of its most painful and appalling forms, gains irony in the more modern view of his affliction, here stated in the note by R. Wyse Jackson:

... as Sir William Wilde [father of Oscar Wilde], that remarkable research student of Swift's last days surmised ... Swift's malady was not properly insanity, but a disease of the inner ear. Dr. Bucknill in 1882 suggested that he was suffering from the final cerebral effects of labyrinthine vertigo, a diagnosis which time has not improved on.

The existence of St. Patrick's today, with its modern buildings and treatments, may thus be regarded as, indirectly, a fruit of 18th century medical ignorance.

The "Short Catalogue of the Exhibition" was compiled by M. J. Craig. It shows many interesting items, which include, in addition to Swiftiana, 18th and 19th century books illustrative of the development of medical knowledge of mental disease. From the Royal College of Surgeons of Ireland was lent, for example, a 2nd edition of Pinel's great work, *Traité médico-philosophique sur l'aliénation mentale* (Paris, 1809), together with a copy of the first English translation, *Treatise on insanity* (Sheffield, 1806). Among much valuable material shown by St. Patrick's itself were the 1st folio edition of the famous *Verses on the death of Dr. Swift*, written by himself (London, 1739); two petitions, dated November 1755 and November 1757, from the Governors of the Hospital to Parliament, asking for government grants to supplement the legacy and other moneys which by then had already been spent on building and land; and a copy of Swift's will, together with the Hospital Charters and Bye-laws (Dublin, 1931). Many original manuscript letters and notes, pertaining both to Swift and to the Hospital, were also displayed, and furniture and other objects which belonged to Swift and which form part of the heritage now preserved in St. Patrick's. A clear picture of Swift's *escritoire*, kept in the Hospital board-room, with portraits of Swift, Stella and Vanessa in the background, is reproduced in the present volume, as well as a portrait which is believed to be of Swift. Another illustration shows a portrait of Dr. Robert Emmet, father of the Irish patriot of the same name, and active as governor, physician and business manager of the Hospital from 1770 to 1803.

Sections on "Swift's Heirs" and on "The Buildings" of St. Patrick's Hospital are also contributed by Mr. Craig. Dr. Moore, the Medical Superintendent, in his opening pages on the modern Hospital refers to the enlightened new Mental Treatment Act. Dr. J. D. H. Widdess, Librarian of the Royal College of Surgeons in Ireland, writes a historical outline of the development of St. Patrick's from 1746 to 1899, and also compiles a list of the officers of the Hospital from 1746 to 1948. This list, with its brief notes, repays careful perusal: first of the "Visiting Surgeons" was John Whiteway, son of that Martha Whiteway who was Swift's cousin and bousekeeper and who, as the deafness of his last years gained upon him, "... almost got into a consumption by bawling in my ears." Dr. R. Wyse Jackson writes briefly of "The Vision of Jonathan Swift", referring to the latter's ironic explanations of his own charitable deeds; he quotes both Swift's verses on his own death, and the comment of the *Gentleman's Monthly Intelligencer* on the satiric Dean's bequest of his whole fortune for a hospital for the mad:

The Dean must die! our idiots to maintain!  
Perish ye idiots! and long live the Dean!

During the uncontrollable last attacks of Swift's disease, his attendant beat him to restrain the frenzies into which he was driven by pain and madness. For a long time the Hospital founded by his charity remained chiefly a place of confinement; the report of the Government Commission of 1815 states that St. Patrick's then contained nearly 200 persons, 51 of whom paid for their board and treatment, the rest being maintained by the charity.

There were but six straw patients in the whole establishment, two of whom were quite naked, having torn their clothes to pieces.

Public opinion was roused by the reforms started in 1792 by Pinel in Paris and by the Quakers in England—in 1796 at York, the latter opened The Retreat, an institution for mental patients which is among the best known of mental hospitals today. Gradually amenities and more humane methods were introduced, and in these improvements St. Patrick's seems to have been generally in the vanguard. Yet it was not until 1839 that John Conolly's system of treatment without restraint of the insane was introduced at Hanwell Asylum; by the time his book was published, the "system was being applied to over 10,000 patients in 24 English asylums", according to the catalogue note here accompanying the entry of an example of his book, *The treatment of the insane without mechanical restraints* (London, 1856).

These reforms are not yet complete. Swift's astringencies can be more tonic today than any complacent survey of what has been accomplished since his time; in no country are accommodation, treatment and attendance yet sufficient in either quantity or quality for the needs of the mentally ill. The satirist's legacy, expanded splendidly into St. Patrick's Hospital, two centuries after his death still points one of the great needs in public health.

<sup>1</sup> [For particulars, see Book Reviews, p. 123.—Ed.]

1327

## MEDICAL AND SCIENTIFIC PHILATELY

One of the most delightful ways of studying the history of medicine or of science is to view it through the eye of the collector. The objects collected are most frequently books and manuscripts, but unwritten history may be read from prints and engravings, or from instruments and drug-jars, and within recent years postage stamps have provided the collector with a new avenue of approach to early medicine and science, a gateway of absorbing interest.

Although medical and scientific philately is little more than ten years old it has attracted considerable attention and has been the subject of more than fifty descriptive articles in the scientific periodicals of eight different countries during those years. But there has been no complete review of the relation between postage stamps and the men and deeds, in medicine and science, which they depict or commemorate. This defect in the literature has now been amply supplied by a librarian and a surgeon, each of whom is an expert philatelist as well as an accredited historian. The result is a fascinating little book<sup>1</sup>. The authors have been concerned with the story behind the stamps, rather than with purely philatelic details. They have been content to stimulate interest in a novel side-line of history, without attempting to enumerate all those stamps which are of medical or scientific interest.

Naturally enough, portrait stamps are the most attractive and also the most numerous in the album of the medico-scientific collector. The first medical man to be portrayed on a postage stamp was Dr. Francisco Espejo, the 'liberator' of his country, who appears upon an Ecuador stamp of 1899, while the first British medical man so to be commemorated was Sir Wilfred Grenfell, whose portrait with the hospital-ship "Strathcona" adorns a Newfoundland stamp of 1941. Other doctors and scientists to whom philatelic honour has been accorded are Imhotep, Vesalius, Paré, Boerhaave, Pasteur, Koch, the Curies, and many others. Conspicuous by their absence are Harvey, Lister, Jenner, and Hunter. Britain has not yet signalized the deeds of her great men by postal commemoration. It may surprise some readers to find among the stamp portraits those of Schiller and Chekhov, of Clemenceau and Sun Yat Sen, until it is recalled that these were medical men who became eminent in other fields. The section dealing with portraiture is made more valuable and interesting by a collection of brief biographies, although the reviewer sought in vain for the Finnish scientist Caloniuss, whose picture is shown on p. 28.

The philately of the Red Cross ranks second only to that of medical and scientific portraits. Indeed, it includes portraits of the founder, Jean Henri Dunant, and of Florence Nightingale, although most of the Red Cross stamps are of symbolic design, as are also many of the stamps issued to assist in the war against tuberculosis, in maternity and child welfare schemes, and in famine relief. A number of stamps are adorned with illustrations of hospitals and sanatoria of universities and medical schools. In this category is included a series of Italian stamps, issued in 1929, and bearing illustrations of the ancient monastery and hospital of Monte Cassino, that noteworthy landmark of medical history which was the scene of violent fighting in the recent war, when the building suffered total destruction. From time to time, medical and scientific congresses have been marked by the issue of special stamps. The latest of such occasions was the Centennial Meeting of the American Medical Association in 1947, when the well-known painting entitled "The Doctor", by Sir Luke Fildes, R.A., which now hangs in the Tate Gallery, was reproduced on a 3 cent stamp.

The reviewer has endeavoured to indicate the scope of a carefully written brochure which, though small, supplies a much-needed account of a new and fascinating bypath of philately and of medico-scientific history. With praiseworthy brevity, the authors have packed into the 24 pages of letterpress a clear and ample outline of the present knowledge, while the illustrations of 148 stamps supply a useful guide to philatelist and historian alike. Print and illustrations are good, although surely such a well-compiled work deserves a better cover, even in times when book-binding difficulties cause many a publisher's headache.

This is a pioneer work, calculated to stimulate interest in medical history as well as interest in postage stamps. There

could be no better present for the schoolboy philatelist or for the adult who takes his hobby more seriously, while even to the reader who tends to scorn the humble postage stamp the book may well serve as an introduction to the history of medicine and science.

Douglas Guthrie

## MEDICAL PORTRAIT STAMPS



Acknowledgements to Harvey & Blythe Ltd.

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1328

## DISSEMINATED SCLEROSIS: AN EARLY ACCOUNT

The severe asthma from which he suffered caused Prince Augustus Frederick, sixth son of George III, to spend much of his early manhood on the continent of Europe. In 1793, while in Rome, he met and clandestinely married the Lady Augusta Murray, being then 20 years old and 11 years younger than his spouse. This marriage was, however, contrary to the provisions of the Royal Marriages Act passed 15 years previously, and was declared invalid, despite a second ceremony at St. George's Church, Hanover Square, London. The two children of the marriage were thus rendered illegitimate.

<sup>1</sup> [For particulars, see Book Reviews, p. 123.]

The boy, Augustus Frederick, was born on 13 January 1794, and his sister Augusta Emma in August 1801. Later in that year the Prince ceased to live with his Lady, who for many years afterwards made strenuous efforts to obtain recognition of her marriage. She was over-indulgent to the boy, both during his schooldays at Harrow and during his life in the Army. He assumed the name Esté in 1809, on the instruction of his father.

Towards the end of 1825, Augustus d'Esté fell in love with the 18-year-old Princess Feodora of Leiningen, half-sister to the young girl who was later to become Queen Victoria. The parents quickly put an end to this affair, and Augustus remained a bachelor for life.

In 1822 d'Esté suffered from a short attack of dimness of vision, which recurred at intervals, accompanied by other symptoms which leave no doubt that he was suffering from what was later recognized as disseminated sclerosis. In his attempts to cope with his affliction he visited many health resorts, both English and European, and was treated by several physicians, but his illness progressed, manifesting all the symptoms associated with disseminated sclerosis, until he died, a pathetic and helpless invalid, in 1848.

The details of the illness of d'Esté would not have become known but for his manuscript diary, in which he recorded in full his symptoms, the prescriptions of his physicians, and other measures taken in a vain effort to cure what was then an unknown malady. The diary itself, *The case of Augustus d'Esté*, came to light, together with a small collection of letters from his mother and others, during a waste-paper drive in 1940. Its historical interest lies in the fact that it is probably the first clinical account of disseminated sclerosis. Sir Robert Carswell first described and depicted a pathological specimen of the conditions in his great atlas, which appeared in parts, being completed in 1838. The illustration was probably completed in 1836, as it is printed by the "lithographers to the King", while later plates in the same atlas were executed by the same lithographers, who now described themselves as "lithographers to the Queen". Jean Cruveilhier was the first to record the history, with pathological correlation, of a case of disseminated sclerosis in 1842, although it is possible that he may have written the history of the case as early as 1838. D'Esté himself was keenly observant and accurate; it is, therefore, not strange that he, a layman, should have compiled so accurate an account of his disease from its first symptoms to its pathetic end.

Chief among the physicians who at one time or another treated d'Esté was Dr. Henry Vaughan, who later changed his name to Halford and eventually became Sir Henry Halford, Bart. He was President of the Royal College of Physicians for 24 years, during which time he was responsible for important changes in the College, including its removal from Warwick Lane to its present site. He also had the unique distinction of being physician-in-ordinary to four sovereigns, George III, George IV, William IV, and Queen Victoria, besides attending many other members of the Royal family.

Credit for the publication of the diary<sup>1</sup>, together with a brief account of the life of Augustus d'Esté, and some of the letters of his mother, is due to Dr. Douglas Firth, who unhappily died before the book appeared. Dr. Firth suggests that the psychological traumata sustained by d'Esté during his unhappy childhood were factors in the etiology of his disease. This little book is a most valuable and interesting contribution to the history of medicine.

L. T. Morton

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<sup>1</sup> [For particulars see Book Reviews, p. 123.]

Dr. Jonckheere.<sup>1</sup> This papyrus is small in comparison with other well-known medical papyri, consisting merely of eight columns, and is entirely devoted to affections of the anus. It is divided into small paragraphs, each with a heading in red ink and consisting of prescriptions for various anal maladies written in almost modern style with a list of constituents, and directions for their compounding and employment. The absence of any reference to magic is notable. Constituents include chiefly vegetable products, such as honey, dates, raisins, and oils, various salts, and human and goats' milk. The compounds are in some cases for oral medication and in others for use as suppositories, enemata or local application to the anus. Indications for their employment are not always clear, but there are references to such conditions as anal prolapse and haemorrhoids.

S. S. B. G.

<sup>1</sup> [For particulars, see Book Reviews, p. 123.]

1330

### AN ENCYCLOPAEDIA OF MEDICAL SOURCES AND EPONYMS

This is the most exhaustive source-book<sup>1</sup> of eponyms so far available. The idea of publishing lists of medical eponyms and references to important original work is of course not new. The late Dr. Isidor Fischer's *Eigennamen in der Krankheitsterminologie*, which appeared in 1931, has proved its worth, and the *Medical bibliography* of Garrison & Morton (1943) includes annotated references both to original papers and to important eponyms, while Dr. Kelly himself has already earned the thanks of medical historians by his scholarly editorship of five volumes of *Medical classics*, in which he made available reprints of the original texts (and translations where necessary) of classical papers in medicine, together with full bibliographies of the writers and the eponyms associated with them.

In this new book he has brought together in alphabetical order over 5,000 personal names with the eponyms connected with them, and gives full title and reference, with dates and brief descriptions of the persons concerned. Important original papers are also included. The references are extremely accurate, but unfortunately the text itself suffers from bad proof-correcting. Misspellings such as "anomaly", "syphygmonograph", "Frölich", "Frählich", should not have been overlooked. Few will recognize Sir Arthur Hurst under his original name of Hertz. On page 326 there is an entry for "Pinto's disease", which is said to be described by E. del Pinto, although pinto (pinta, carate) is generally considered to have been so named from the Spanish *pintar*, to paint. Some of the descriptions of the writers will not be universally acceptable; Sir William Osler is described as a "Canadian, American and English physician"; Lettsom, founder of the Medical Society of London, as a "Virgin Island physician"; Sir Thomas Lewis, the Welshman who achieved his great reputation as a cardiologist in London, as an "English physician"; the Italian Aldo Castellani as an "Anglo-Indian physician"; and Sir Howard Florey, the Australian professor of pathology at Oxford, as an "Oxford pathologist". Henry Newell Martin, the Irish physiologist who was a Fellow of the Royal Society and became professor of biology at Johns Hopkins, is described as "a Baltimore biologist". Many emigrants are described as belonging to the land of their adoption, particularly when this is the USA, even when the work ascribed to them was written in their native land. An immense amount of labour must have gone into the preparation of this book, but insufficient care seems to have been taken in the final stages.

These shortcomings, however, do not prevent the book from deserving its place as one of the most important additions to medical bibliography of recent years, of value alike to medical students, practitioners, research workers, librarians, and medical historians. The writer is to be congratulated on his great industry in producing it.

L. T. Morton

<sup>1</sup> [For particulars, see Book Reviews, p. 123.]

1329

### PROCTOLOGY IN ANCIENT EGYPT

Papyrus No. 6 of the Chester Beatty Collection in the British Museum has been translated into French for the first time by

# Book Reviews

## ANAESTHESIA

### 1331 The Chemistry of Anaesthesia

John Adriani. Oxford: Blackwell Scientific Publications, 1946. viii + 530 pages; 45 figures. 23 x 15 cm. £1 15s. [£1.75]

Part I. The physical behaviour of gases; (i) The physical behaviour of gases; (ii) the chemistry of absorption of carbon dioxide in rebreathing; (iii) the chemistry of anaesthesia. (v) The chemical nature of anaesthetic drugs; (vi) hydrocarbons; (vii) alcohols; (viii) aldehydes and ketones; (ix) acids, acyl derivatives, and esters; (x) ethers, alkene oxides, and acetals; (xi) halogenated compounds; (xii) sulphur-containing substances—sulphonemethanes; (xiii) aromatic and heterocyclic compounds; (xiv) opium and opium alkaloids; (xv) amides, ureides, and related compounds; (xvi) local anaesthetic drugs; (xvii) drugs affecting the autonomic nervous system; (xviii) stimulating drugs used as anaesthetics; (xix) standards of purity of drugs; (xx) inflammability of anaesthetic mixtures. Part III. Biochemistry related to anaesthesia. (xxi) Chemical basis of proposed mechanisms of narcosis; (xxii) effects of anaesthesia upon composition of body fluids; (xxiii) effects of anaesthesia upon composition of body fluids (continued); (xxiv) effects of anaesthesia upon composition of body fluids (concluded); (xxv) the effects of anaesthesia on liver function; (xxvi) effects of anaesthesia upon formation and composition of urine; (xxvii) effects of anaesthetic drugs on lipid and nervous tissues; (xxviii) enzymes, vitamins and hormones; (xxix) metabolism during anaesthesia; (xxx) detoxification and elimination of anaesthetic drugs; (xxxi) toxicology; (xxxii) biochemical aspects of local anaesthesia. Bibliography. Glossary. Appendix. Index.

Anaesthesia has become such a highly technical subject in recent years that there is a real danger that the basic sciences upon which it is founded will be forgotten.

The part which physics plays in the specialty has already been dealt with by an admirable textbook from Oxford. Professor Adriani now sets out with a similar object on behalf of chemistry and he has succeeded very well.

The book is divided into three sections—inorganic chemistry, organic chemistry and biochemistry. These are followed by a most comprehensive bibliography of 44 pages, a glossary of technical terms, various tables of reference, and an index.

The style is clear and lucid and every variety of general anaesthetic, basal narcotic and local analgesic is dealt with from the chemical aspect. The only statements found which do not entirely correspond with opinion in Great Britain concern synergism and trichlorethanol. The existence of the former phenomenon is not universally admitted by pharmacologists; and no mention is made of the risk of primary cardiac failure which led to the abandonment of trichlorethanol in this country.

The book is excellently produced and has very few printing errors.

C. Langton Hewer

### 1332 The Development of Inhalation Anaesthesia: with Special Reference to the Years 1846-1900

Barbara M. Duncum. London: Geoffrey Cumberlege, Oxford University Press, 1947. (Publication of the Wellcome Historical Medical Museum.) xvi + 640 pages; 161 figures. 22 x 14 cm. £1 15s. [£1.75]

Part I. The preparatory period. (i) Respiration and pneumatics; (ii) etherization. Part II. The use of ether. (i) physiology of anaesthesia; (ii) with chloroform. Part III. The period of the predominant use of chloroform. (vii) Search for the 'perfect' anaesthetic; (viii) chloroform in practice c. 1850-70; (ix) the Chloroform Committee of 1864. Part IV. Revived use of nitrous oxide and of ether. (x) Nitrous oxide; (xi) ether in England. Part V. Continental developments. (xii) Paul Bert's contribution; (xiii) 'mixed anaesthesia' and premedication; (xiv) ether on trial: Switzerland—Denmark—Germany—France. Part VI. The beginning of modern anaesthesia. (xv) Hyderabad Commission and its consequences; (xvi) anaesthetic trends in England, 1890-1900; (xvii) some new developments; (xviii) the jubilee of anaesthesia. Appendices. Summary of events in anaesthesia, 1772-1911. Index.

It is appropriate that Oxford should produce this volume, which is as outstanding for its literary qualities as for its precise and ever interesting presentation of the details of the discovery and subsequent development of inhalation anaesthesia. A notable feature of the book is the documentation, which is ample

but never redundant or irrelevant. Dovetailing of quoted excerpts into the text is accomplished with an adroitness that preserves the continuity of the narrative. In dealing with bygone controversies, of which this particular subject has had an unenviable share, the author shows considerable forensic ability and discrimination in assessing the evidence, an excellent example of this being her co-ordinated analyses and discussion of the reports of the Glasgow (1880), Hyderabad (1889) and later Committees which considered the then serious problem of deaths under chloroform. The many colourful personalities who played parts in this significant epoch of medical history must have been tempting subjects for biographical digression, but although, probably wisely, this has been kept minimal, the reader is given adequate delineation of the characters themselves by the abstracts from their writings. Illustrations of high quality, a clear format and typographical excellence are production features worthy of the authoritative text.

The book will appeal to general readers as much as to specialists, but for the latter the historical interest is supplemented by informative technical and physiological data, associated with the evolution of inhalational methods, which they would do well to ponder.

John Gillies

## AVIATION MEDICINE

### 1333 Pilot Error: Some Laboratory Experiments

D. Russell Davis. London: His Majesty's Stationery Office, 1948. (Air Ministry, A.P. 3139A.) 39 pages; 9 figures. 24 x 15 cm. 9d. [£0.0375]

(i) The role of laboratory experiment in the study of pilot error; (ii) principal results; (iii) analysis of the errors; (iv) individual differences of reaction; (v) applications to flying. Index.

The author of this monograph has made a valiant attempt to assess those characteristics which render pilots liable to accidents in handling the complicated pieces of machinery embodied in modern warplanes. During the war, he investigated a large number of pilots on a tripartite basis. Firstly, he employed a device known as the Cambridge Cockpit, designed by the late Dr. K. J. W. Craik, which sought to reproduce, on terra firma, actual flying by instruments. A second test, the Skilled Response, explored reactions to simple, complicated and ambiguous stimuli. Finally, Dr. Davis scrutinized the psychiatric assessments of pilots as regards neurotic predisposition, with a view to correlating these findings with his cockpit experiments. He elicited three major types of reaction to his cockpit: (i) overactivity with tension and occasional florid anxiety; (ii) inertia with flagging interest and mild boredom; and (iii) certain end effects associated with the approaching termination of the test, consisting largely of relaxation of effort.

*Inter alia*, ancillary experiments revealed that noise had variable, highly individual and unpredictable effects and that drugs were of no special importance except, as usual, in the case of alcohol. Doses of whisky (a good brand of Scotch whisky is specifically mentioned!) produced severe performance deterioration, confirming what is already known of the effects of alcohol on skilled occupations. Furthermore, special instructions, which warned pilots of the kinds of possible error and other adverse circumstances, had a favourable effect which became less evident the later in the test these were imparted. Fatigue was found to play little or no part in the causation of pilot error. Rather was it anticipatory tension which interfered with performance.

In this regard, psychiatric assessments and subsequent "follow-ups" proved interesting. Over 1,000 pilots, including 39 neuro-psychiatric patients, were interviewed, 383 having been submitted to the Cockpit Test. They were classified in respect of neurotic predisposition and again as to whether their reactions were normal, overactive or inert. Briefly, the patients revealed a very high percentage of abnormal reactions. Those with anxiety states tended to over-react whereas hysterics revealed inertia; the more severe the neurotic predisposition the larger the proportion of abnormalities.

As regards prognostic indications a follow-up showed that "inert reactors" were much more frequently suspended from flying training than other subjects, sustained more fatal accidents

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and more often became operational casualties. In the final analysis, this paper demonstrates conclusively the importance of temperamental factors in determining the safety of potential pilots. It follows that tests of temperament predicting *panache* or the reverse in pilots are eminently necessary. However, it is doubtful whether the Cockpit Test satisfies the requirements. It is free from aerial hazards and can be applied only to individuals with flying experience. Furthermore, psychiatric scrutiny as an adjunct is not infallible; there are too many imponderables in the totality of neurotic predisposition.

Nevertheless, the author has made a distinctive and valuable contribution to a difficult topic and his declaration that much more research is necessary in this field can be fervently endorsed.

H. C. Beccle

### 1334 Aviation Medicine in its Preventive Aspects. An Historical Survey

John F. Fulton. London: Geoffrey Cumberlege, Oxford University Press, 1948. (University of London Heath Clark Lectures, 1947.) viii + 174 pages; 43 figures. 22 x 14 cm. 12s. 6d. [£0.625]

(i) Altitude sickness and acclimatization: the history of oxygen; (ii) decompression sickness: the genesis of the tissue bubble; (iii) pressure cabins and explosive decompression: the spring of the air; (iv) effects of acceleration: dim-out and black-out; protective measures; (v) man and the machine: problems of safety in flight. Index.

This is an interesting historical survey of certain important researches and developments in aviation medicine carried out by the Allies during the war period 1939-46. It is divided into five chapters, dealing respectively with altitude sickness and acclimatization, decompression sickness, the physiological problems of pressurized aircraft cabins, the effects of acceleration on man, and the problems of safety in flight.

The recent altitude acclimatization experiment carried out at the United States Naval Air Station in Pensacola, Florida, is described in some detail. This interesting investigation, named "Operation Everest", was under the direction of Commander Charles Houston, who had twice climbed in the Himalayas. The experiment was devised to secure impartial data on the respiratory and circulatory changes which occur through acclimatization to lack of oxygen at an altitude level of 23,000 feet without supplementary oxygen. Four young adults lived for five weeks in a low-pressure chamber fitted with an air lock, so that observers could enter to make observations and take appropriate samples. The results showed that acclimatization consists of a series of integrated adaptations to restore the oxygen pressure of the tissues to the normal sea-level value.

Decompression sickness is reviewed, from Leonard Hill's work in 1912 on the caisson sickness of divers, resulting from too rapid an ascent from depths and causing acute body pains ("bends") and respiratory distress ("chokes"), to similar conditions which occurred among personnel in the RAF in 1939 engaged in high-altitude photographic reconnaissance. Researches by the RAF Physiology Research Team at Farnborough, followed by those of the Canadians and Americans, are dealt with in some detail, particularly the fundamental research under the chairmanship of Dr. John Fulton. The American group studied bubble formation in the blood and tissues of animals in relation to "bends", and the underlying factors, such as gas tension, hydrostatic pressure, surface tension and gas nuclei. These researches led to practical results in operational flying, whereby "bends" were prevented or ameliorated by pre-oxygenation before a high-altitude flight, and by limitation of muscular movements during flight to lessen the formation of bubbles in the blood vessels.

As regards pressurized aircraft cabins, the valuable data obtained by Piccard of Belgium and Stevens and Anderson of the USA, using pressurized gondolas, were instrumental in enabling Harry Armstrong at Wright Field to draw up in 1935 the first specification of physiological design criteria for such cabins (published in abstract form in 1936). The main physiological problems concerned ventilation and explosive decompression. The first work on explosive decompression was done by the French workers, Garsaux, Richou and Laurent, in 1939, using animals. In 1941, R. H. Winfield in Great Britain and J. J. Smith in the USA, independently experimenting on themselves, showed that no perceptible harm is caused to a fit man by explosive decompression, provided an adequate supply of oxygen

is immediately available, or a rapid descent is made to non-oxygen-requiring altitudes. Survival times after explosive decompression at various altitudes up to 75,000 feet were worked out by Gelfan, Nims and Livingston in the USA. At altitudes above 52,500 feet, respiration ceases within 18 seconds after such an explosion. The time of "useful consciousness" without oxygen at 30,000 feet was found to be approximately 2 minutes, and if oxygen were not supplied, death would occur within 10 minutes.

Broca and Garsaux in France in 1918 were the first to demonstrate the pathological effects on animals of high centrifugal acceleration. The Germans initiated centrifugal researches on man in 1935. In Great Britain intensive researches of an *ad hoc* nature were begun in 1939 by Matthews and Stewart, using a flying laboratory in an aircraft fitted with a cine-camera to record the effects of high acceleration under conditions of aerial combat. This enabled suitable remedies to be devised. Important fundamental researches in centrifugal machines in the laboratory, first in Canada by Franks, then in Australia by Cotton, and later in the USA at the Mayo Clinic, Wright Field, and Pensacola, added much to our knowledge of the effects of centrifugal forces on man, and culminated in the development of anti-gravity suits, first of the hydraulic type and later of the air-pressure variety. It is claimed that the air-pressure anti-gravity suit did much to give Allied fighter pilots ascendancy over the enemy.

The problems of safety in flight include valuable work by De Haven in the USA from the study of the effects of forces of deceleration on man as demonstrated in aircraft crashes and non-fatal suicidal leaps. The protective value of seat-belts, safety harness, stressing of seats, backward facing seats, and "ditching drill", as adopted by the RAF, is reviewed.

H. E. Whittingham

## BRITISH PHARMACOPOEIA

### 1335 British Pharmacopoeia 1948

General Council of Medical Education and Registration of the United Kingdom. London: Published for the General Medical Council by Constable & Co. Ltd., 1948. xi + 914 pages. 23 x 15 cm. £2 5s. [£2.25]

(i) General notices; (ii) precautionary legal notice; (iii) monographs. Appendices. Index.

[The appearance of this edition, the 7th, of the *British Pharmacopoeia* is an event of considerable interest and importance. The 6th edition was published in September 1932; war conditions made it impossible to bring out the following edition at the normal 10-year interval. The present volume, therefore, bridges a gap of some 17 years. Seven addenda to the 6th edition have appeared; in the present volume these have been largely revised prior to inclusion. This work is a continuing enterprise, and much of the labour for the present volume was therefore carried out under war conditions with their attendant difficulties. The acceleration of medical research due to the demands of war has further added to the labours of the authors. A review by Professor Mayrs of the new edition appears below.]

Since the *British Pharmacopoeia* (B.P.) was first compiled in 1864 one of its purposes seems to have undergone a gradual change. A drug was not necessarily excluded from the early issues after its therapeutic value had become doubtful. The *Pharmacopoeia* thus maintained standards for drugs in common use, without much regard for their actual usefulness. As stated in the preface to the issue of 1867, the object was "not so much the selection as the definition of substances which the physician requires." But in 1932 evidence of a different attitude began to appear. Some valueless drugs, still widely employed, were excluded; so that pressure, however slight, was directed against their use. In the new issue this attitude is more obvious; none of the drugs included can be described as useless, though a few may be considered unnecessary.

While the disappearance of a drug from the *Pharmacopoeia* usually indicates that it has failed to hold its place in therapeutics, the absence of a new drug does not imply that it is without merit. An interval must elapse before its therapeutic and toxic effects are confirmed, and for this and other reasons judgement must be postponed. The 1948 B.P. appears to contain most of the new drugs about which there is now fairly general agreement.

In the preface to the new *Pharmacopoeia* the General Medical Council states that its preparation has been more laborious than that of any of its predecessors. This can well be believed, and the Pharmacopoeia Commission is to be congratulated on a fine piece of work. The compilers do not claim the divine inspiration of Aesculapius to protect them from criticism, but they are protected to some extent in another way. They have had at their disposal the views of experts in many branches of medical science, while few potential critics are likely to be expert in more than one.

Some points of interest to medical men may be mentioned. The pure glycoside ouabain, which appeared under the name strophanthin-G in the 7th Addendum to the 1932 issue, has replaced strophanthin (the mixture of glycosides from *Strophanthus Kombé* Oliver). Its official recognition has been slow, and it may suffer in competition with the newer drug, digoxin, which has had a shorter period of probation. The maximum dose recommended for ouabain is one-fourth that of the old strophanthin.

The synthetic anthelmintic, diphenan, known for many years under various proprietary names, has now become official—perhaps an admission that gentian violet does not completely solve the problem of treating threadworm infestation. Diphenan is a relatively non-toxic substance.

An unusual event is the reappearance of a drug which once lost its official status. Picrotoxin was included in the 1898 B.P. but was rejected in 1914. Its value in the treatment of narcotic (especially barbiturate) poisoning is now recognized. The retention of squill and the continued recommendation of oral doses for the double salts of antimony may cause some surprise. Squill, though much used, has disadvantages as an expectorant, and would probably not be missed; tartar emetic is seldom given by mouth.

Crude preparations of cinchona have disappeared, and the minimum dose recommended for the chief quinine salts has been increased. The use of quinine as a bitter tonic is thus discouraged.

Doses in general have not been much altered, and the few changes which have been made seem to conform with current practice. The doses of some vitamins have been increased, the dosage of dilute hydrochloric acid has been doubled, and the maximum dose of chloral hydrate has been raised to 30 grains. The dosage of quinine sulphate is halved. Small metric doses of solids are now expressed in milligrams instead of grams.

The numerous injections and tablets now included are probably of more direct interest to manufacturers than to doctors; but, before prescriptions are written, the availability of tablets of the required drug-content should be ascertained.

A leaflet has been issued with the *Pharmacopoeia* in which are listed the official names of recent pharmacopoeial drugs, and also approved names for some other drugs not at present included. If the nomenclature of drugs is to be saved from hopeless confusion these names must be used whenever possible.

This new B.P. is in no danger of unfavourable comparison with its predecessors.

E. B. C. Mayrs

## CARDIOVASCULAR SYSTEM

### 1336 Electrocardiography and Clinical Disorders of the Heart Beat. A Handbook for Practitioners and Students

Thomas Lewis. London: Shaw & Sons Ltd., 1949. xiv + 285 pages; 215 figures. 22 × 14 cm. £1 5s. [£1.25]

(i) The electrocardiographic method; (ii) the physiological electrocardiogram; (iii) the electrical axis; (iv) rhythmic but anomalous electrocardiograms; (v) electrocardiogram of special states; (vi) sinus slowing and irregularities; (vii) heart-block; (viii) premature contractions or extrasystoles; (ix) simple tachycardia; (x) paroxysmal tachycardia; (xi) auricular flutter; (xii) auricular fibrillation; (xiii) ventricular fibrillation and premonitory mechanism syncope; (xiv) competing rhythms; and some rare disorders; (xv) alternations of pulse and heart. Appendix. Index.

In this last publication of the late Sir Thomas Lewis two of his previous works, *Clinical disorders of the heart beat* and *Clinical electrocardiography*, are presented in one volume with obvious advantages. The book is written for practitioners and students, and although the author claims to have brought its contents up to date, it is better regarded as a classic than as a modern

treatise; as such it must occupy a welcome place in our library. At the same time, it reminds us sharply that the host of new leads has extended the practical value of electrocardiography but little, and has added nothing to the analysis and interpretation of disorders of rhythm; thus this latter section reads as well today as when it was first written.

Not the least of Lewis's many great qualities was his ability to describe in simple terms the conclusions to which he had been led by much hard work and complex experiment, so that the general practitioner and ordinary patient could benefit directly from them. It is indeed a pleasure to turn from the jargon of current medical literature to the well-constructed phrases and precise English of a scientist who knew how to write.

Paul Wood

### 1337 Subacute Bacterial Endocarditis

Emanuel Libman & Charles K. Friedberg. Second edition. New York: Oxford University Press, 1948. vii + 113 + 3 pages; 19 figures. [Reprinted from Oxford Loose-Leaf Medicine with the same page numbers as in that work.] 24 × 16 cm. £1 1s. [£1.05]

(i) Definition and classification of endocarditis; (ii) classification of bacterial endocarditis; (iii) subacute bacterial endocarditis; (iv) mild cases of subacute bacterial endocarditis; (v) the bacteria-free stage; (vi) transitional cases of subacute bacterial endocarditis; (vii) recurrent cases of subacute streptococcal endocarditis; (viii) prognosis of subacute bacterial endocarditis; (ix) cause of death in subacute bacterial endocarditis; (x) prophylaxis of subacute bacterial endocarditis; (xi) treatment of subacute bacterial endocarditis. Bibliography.

The well-known contributions of the late Dr. Emanuel Libman to the study of subacute bacterial endocarditis have been revised by Dr. Charles Friedberg. This monograph provides an exhaustive study of the pathology, symptomatology and treatment of this fascinating and important disease. The bibliography is complete and includes the experience with penicillin and other forms of chemotherapy up to September 1947.

With the change in outlook of the disease and modification of its course by modern treatment, a good deal of new basic knowledge is bound to accrue. Opportunities will arise for direct microscopic study of the mode of healing of bacterial endocarditis, and the long-term results of some of the renal complications in cases where the primary cardiac condition has been cured will require further study. The purpose of the Oxford Loose-Leaf Medicine is to keep the readily available information well up to date, and this monograph can be thoroughly recommended to all who are interested in the immense variety of clinical manifestations arising in the course of subacute bacterial endocarditis.

## CHEMOTHERAPY

### 1338 The Basis of Chemotherapy

Thomas S. Work & Elizabeth Work. Edinburgh: Oliver & Boyd Ltd., 1948. xx + 435 pages; 42 figures; 38 tables. 23 × 15 cm. £1 6s. [£1.3]

(i) Introduction: historical; (ii) cell metabolism; (iii) essential metabolites; (iv) enzyme inhibition; (v) drug antagonism; (vi) drug resistance; (vii) the relation of structure and activity of drugs. Epilogue—Chemotherapy as a science. Index.

A broad account of the theoretical principles on which modern chemotherapy is based has long been needed. Though limited advances can be made by the extension of facts based on empirical discoveries, true progress in a subject must rest on a sound knowledge of its underlying principles. Of all the branches of medical science, chemotherapy provides perhaps the best example of a field of enquiry which is the meeting-place of many different sciences. To give a logical account of its development and of its future possibilities, it is necessary therefore to extract the relevant principles from these sciences, and to show the synthesis from them of the new knowledge of the mode of action of antibacterial substances.

With this in view the authors of this book have wisely included chapters of a more general nature on cell metabolism and on the mechanism of enzyme inhibition. They have described the main enzyme-catalyzed reactions on which the life of the cell depends, and have summarized the evidence on which is based the view that

a given metabolite is essential for a given bacterial species because it is a constituent of one of these essential enzyme systems, which the bacterial cell cannot itself synthesize. Seen in the light of this work, it now seems probable that substances act as growth inhibitors because in one way or another they inhibit these enzyme systems, and a clear account is given of the relation of bacterial growth inhibitors to essential metabolites, and of the various ways in which enzyme inhibition may be brought about.

Recent developments which are beginning to throw light on the relation between chemical structure and chemotherapeutic activity are also described, and the way is indicated for future developments in this field.

A welcome inclusion in this book is a well-written chapter on the history of the development of modern chemotherapy, an introduction that traces the subject back past Koch and Lister and Pasteur to the earlier proponents of the theory of the contagious nature of disease. It is a book which presents in a clearly written way the development and the logic of modern chemotherapy; while paying due attention to the broad principles underlying the subject, it presents a complete and up-to-date picture of our present knowledge of its mechanisms, and, with its full bibliography, is therefore of value and of interest to the research worker as well as to the advanced student.

R. H. S. Thompson

## CHEST DISEASES

### 1339 A Practical Manual of Diseases of the Chest

Maurice Davidson. Third edition. London: Geoffrey Cumberlege, Oxford University Press, 1948. xvi + 670 pages; 268 illustrations. 25 x 17 cm. £2 10s. [£2.5]

Section A. Preliminary considerations. (i) The elementary anatomy and physiology of the respiratory mechanism; (ii) radiology of the chest; (iii) the relation of chest disease to general medicine and pathology; (iv) systematic examination in disease of the chest. Section B. Diseases of the upper respiratory tract. (v) Diseases of the nasopharynx; (vi) diseases of the larynx. Section C. Diseases of the lower respiratory tract. (vii) Bronchitis; (viii) bronchiectasis; (ix) foreign bodies in the bronchi. Section D. Asthma. (x) Asthma: aetiology and pathology; (xi) asthma: clinical features and treatment. Section E. Diseases of the pleura. (xii) Pleurisy and pleural effusion; (xiii) pneumothorax, etc.; new growths of pleura. Section F. Diseases of the lungs. (xiv) Conditions affecting the air in the alveoli; (xv) conditions affecting the circulation in the lungs; (xvi) the pneumonias; (xvii) the pneumonias (continued); (xviii) fibrosis of the lung; (xix) industrial respiratory diseases; (xx-xxiv) pulmonary tuberculosis; (xxv) specific non-tuberculous infections of the lung. Section G. Intrathoracic suppuration. (xxvi) General principles in the diagnosis and treatment of intrathoracic suppuration; (xxvii) empyema thoracis; (xxviii) abscess and gangrene of the lung. Section H. Intrathoracic new growths. (xxix) Malignant new growths of the lung and bronchus; (xxx) non-malignant growths of the chest; (xxxi) prognosis and treatment in bronchial carcinoma; (xxxii) lymphadenoma; (xxxiii) cysts of the lung and pleura. Miscellaneous. (xxxiv) Differential diagnosis in regard to certain obscure clinical and radiological phenomena; (xxxv) affections of the mediastinum; (xxxvi) sarcoidosis; (xxxvii) oxygen therapy. Appendix. Formulae of prescriptions. Index of authors. Index of subjects.

Dr. Davidson's textbook of diseases of the chest was first published in 1935. The appearance of the 3rd edition has been delayed by the war. In it he has made a number of additions and revisions. Certain of the reproductions of radiographs have been replaced by more satisfactory ones. The basic plan of the book, however, remains unchanged. Its object is to present from the point of view of the practical physician a readable account of current practice in chest diseases. Case reports from the author's life-long experience are added in the text to illustrate practical points. At the end of each chapter there is an adequate list of references both to more detailed textbooks on special subjects and to original papers.

Dr. Davidson's literary style is leisurely, and brings with it a reminder of more spacious days. The younger physician will find described here certain methods which he may think outmoded; for instance the creosote chamber in bronchiectasis, and the use of atropine for pulmonary oedema. While the emphasis of the book is on practical aspects, space is not always allocated in accordance with the importance and frequency of diseases in practice; for instance the section on asthma consists of only 19 pages out of the 670 which the book contains. It is unfortunate that in the chapter on bronchiectasis the diagrams and nomenclature of bronchial anatomy published by Nelson in 1934 are reproduced; whereas in a note on the anatomy of the bronchial

tree and in the section on bronchography, which has been revised, with very helpful line drawings to clarify the illustrative bronchograms, the later anatomical nomenclature of Foster-Carter and Hoyle is used. Certain omissions are an indication of the rapid advances which have been made in knowledge in the last few years. For instance the clinical application of streptomycin has developed so recently that it is not mentioned in the section on pulmonary tuberculosis; in the section on fungus diseases of the lung coccidioidomycosis and histoplasmosis, on which so much recent work has been done in the USA, receive no mention; and in the section on atypical pneumonias rickettsial and ornithotic pneumonias are not mentioned.

These are minor criticisms; on the whole the book can be recommended as a reliable account of chest disease, which will rarely fail to give the physician some indication of what to do when faced with practical clinical problems, and will give the student an acquaintance with chest disease soundly based on clinical experience.

J. G. Scadding

### 1340 The Child's Lung: Developmental Anatomy, Physiology and Pathology

Stefan Engel. London: Edward Arnold & Co., 1947. viii + 332 pages; 283 illustrations. 22 x 14 cm. £2

Part I. The bronchial tree and the bronchial glands. (i) Macroscopical anatomy; (ii) the bronchial and bronchiolar distribution and arrangement; (iii) the developmental histology of the bronchial tree; (iv) the patency of the air-passages; (v) the air-cleansing function of the bronchial tree; (vi) general pathology of the bronchial tree; (vii) bronchial and bronchiolar catarrh, bronchitis and bronchiolitis; (viii) bronchiectasis; (ix) the bronchial glands; (x) the hilum; (xi) pathology of the bronchial glands. Part II. The lung. (xii) The foetal lung; (xiii) developmental anatomy of the thorax and the lung; (xiv) general remarks on the histology of the lung; (xv) the respiratory bronchioles; (xvi) the acinus of the infant's lung; (xvii) the growth of the lung; (xviii) the elements of the lung-tissue; (xix) the blood supply of the lung-tissue; (xx) the alveolar pores; (xxi) function of lung in relation to morphology; (xxii) unifocal or lobar pneumonia; (xxiii) dyslectatic-paravertebral pneumonia; (xxiv) multifocal or broncho-pneumonia; (xxv) radiology; (xxvi) the miliary tubercle; (xxvii) the pulmonary primary tuberculous complex in various age-periods; (xxviii) diseases of the lung according to age-periods. References. Index.

This book describes the anatomy, physiology and pathology of the child's lung, and is based on original work done by the author at the Hospital for Sick Children, Great Ormond Street, London, where he was a special research fellow.

It is divided into two parts: Part I deals with the bronchial tree and bronchial glands and Part II with the lung itself. In the earlier chapters, the author points out the relative lengths in the bronchial tree of the trachea and main bronchi at various ages, from the newborn infant to the adult. Three facts emerge: (i) the trachea and main bronchi do not grow continuously at the same rate; (ii) the right bronchus is wider than the left, and (iii) the ratio of the right to the left bronchus remains unchanged from birth to adult life. The author also points out the comparatively short length of the trachea during the early years of life and attributes to this fact, among other considerations, the greater prevalence of catarrhal bronchial disease in young children.

Several chapters are devoted to the exact anatomy of the bronchi and bronchioles and its bearing on the pathology of bronchitis, bronchiolitis, bronchiectasis, collapse, etc. In addition, an exact description is given of the bronchial glands and their relation to primary foci and to tuberculous meningitis. In this connexion, the author points out that, as a result of much investigation, it has been found that cases of low-grade pyrexia and general ill-health hitherto attributed to hilar tuberculosis may occur with equal frequency in children who are Mantoux negative. The statistics which he gives of hilar tuberculosis in various age-groups are of considerable interest. He groups forms of pneumonia under six headings: (i) dyslectatic, paravertebral pneumonia (infants); (ii) septic pneumonia (infants); (iii) foreign body (aspiration) pneumonia, lipoid pneumonia; (iv) multifocal pneumonia (bronchopneumonia); (v) unifocal (lobar) pneumonia; (vi) "atypical pneumonia" (pulmonary inflammation, pneumonitis). A full description of each variety and their relative occurrences at different ages is given.

It is worth noting that, in a series of 313 cases of measles, there were 86 cases of pneumonia and among them 55 (64%) were of multifocal, and 31 (36%) of unifocal, character. The mortality in the first category amounted to about 55%, whereas in the second group no deaths occurred.

The chapter on radiology and its relation to anatomy and pathology is of some importance. There is also a short chapter on military tuberculosis, pointing out that, in addition to the better-known malignant type, there is a benign type from which recovery is usual. A special chapter of great interest is devoted to diseases of the lungs according to age-groups. At the end of the book is an extensive and useful list of references to books, monographs and papers bearing on the subject.

A. G. L. Reade

## CHILD PSYCHIATRY

### 1341 *The Psychoanalytic Study of the Child.* Volume II 1946

Edited by Anna Freud et al. London: Imago Publishing Co., Ltd., 1947. 424 pages. 24 x 16 cm. £1 10s. [£1.5]

(i) Problems of child development; (ii) clinical problems; (iii) guidance work; (iv) problems of education and sociology; (v) history of child psychiatry.

We have become accustomed to a high standard of production in publications from psychoanalytic sources, and this volume is no exception. It contains articles of varying character. Some are purely theoretical, while others contain more or less detailed analyses of particular symptoms, such as tic, enuresis, and reading disabilities. There is also a group of papers on the psychoses of childhood, and others are directed towards studying the ways of educating children in emotional experience both directly and indirectly through the various persons in the environment. Lastly there is a paper by the late Dr. Kate Friedlander on child guidance, to remind us of her pioneer creation of the first child guidance unit in this country inspired by purely psychoanalytic concepts.

In the face of this broad front it is out of the question to do more than give certain reflections about the position in child psychiatry which this book displays. As a representative volume on the present position in psychoanalysis it is somewhat deceptive; it is a retrenchment, and we find a gap which should be filled in by those trends in psychoanalysis that seem to open up new vistas.

From certain comments in the book, as well as from the absence of articles by some well-known child psychoanalysts, it appears that the editors of this volume have decided to reject out of hand the work of Melanie Klein and her associates, and the book suffers in consequence. There is also a lack of analytic grasp when we arrive at the psychoses in childhood, and, though there is a first class article by Spitz on anaclitic depression, it is psychiatric rather than analytic in outlook. This particular article is marred by the most peculiarly loose statements about several analysts, e.g. Mrs. Klein, Adler, Rank, Reich and Jung. I am not in any position to be certain about the others, but it is quite wrong to say that Jung assumes "... that human beings are born with a finished and complete psychic structure."

With so much to the credit of the editors it is a pity that this statement should have been allowed to creep in. One would have thought less of it were it not that psychoanalysts have too often proved unable to overcome the temptation to eject those who do not conform to the theoretical framework. In doing so they maintain a certain purity, but it is a phenomenon which makes the claim to scientific objectivity dubious. Indeed, the tendency of psychoanalysis to become a cult is still there, as it has always been. This book is an example of the value contained within the walls of the cult which are now, apparently, in the process of being rebuilt after partial demolition.

These general criticisms should not, however, prevent those interested in child psychiatry from getting hold of this book and reading it from cover to cover. In it they will find descriptions of much that they know, but at almost every turn there will be new material which can deepen their understanding of the infantile psyche. Without practical experience of an analytic kind the longer articles will be difficult to evaluate. Without some idea of the analytic process, the description of the psychic development of any given case always sounds somewhat incredible, but it cannot be said that any better method of presentation can be found.

Michael Fordham

### 1342 *Developmental Diagnosis: Normal and Abnormal Child Development. Clinical Methods and Pediatric Applications*

Arnold Gesell & Catherine S. Amatruda. Second edition, revised and enlarged. London: Hamish Hamilton Medical Books, 1947. xvi + 496 pages; 22 illustrations. 24 x 16 cm. £1 12s. 6d. [£1.625]

Part One: Principles and methods. (i) The development of behavior; (ii) the developmental examination of behavior; (iii) norms of development; (iv) conduct of the examination. Part Two: Problems of differential diagnosis; (v) Problems of high grade; (vi) low grade amentia disorders; (vii) the neurological diagnosis of infant behavior; (viii) cerebral injury; (ix) blindness; (x) deafness; (xi) prematurity; (xii) precocity; (xiii) environmental retardation; (xiv) clinical aspects of child adoption. Part Three: The protection of early child development. (xv) Diagnosis and guidance; (xvi) developmental pediatrics. Appendices. A. Examination technique. B. Growth

This is a book with a somewhat ambiguous title, but after perusal the reader is left in no doubt as to its pertinence. Briefly the title implies that by an objective study of certain behaviour reactions of an infant the maturity and organization of its neuromuscular system can be diagnosed and a developmental quotient obtained which will serve as a useful guide for prognosis.

At the Yale Clinic of Child Development Dr. Gesell and Dr. Amatruda have for a number of years made a systematic and extensive study of normal child development during the first three years of life, in particular the development of certain of the sensorimotor neurones associated with the head, eyes, mouth, arms and hands, ear, larynx, etc. As a result of their research the authors have devised a series of 'behaviour tests', arranged in nine age-groups, applicable to children between the ages of four weeks and three years. No elaborate apparatus is needed for carrying out these tests, the material required being such common objects as balls, cubes, rattles, bells, etc. The tests have been devised to cover the fields of motor behaviour, adaptive behaviour, language behaviour and personal-social behaviour. The purpose of the tests is to determine a child's behaviour development, from which information his Developmental Quotient (DQ) can be expressed as a percentage by using the formula:

$$DQ = \frac{\text{Maturity age}}{\text{Chronological age}} \times 100.$$

That the efficient carrying out of these behaviour tests is not as simple as the apparatus used might suggest is indicated by the fact that the Yale Clinic provides specialized courses of post-graduate training of one or two years' duration for paediatricists. It is interesting to note that at this course use is made of an extensive series of cinema records of infants' behaviour development at different ages.

Part Two of the book (over 200 pages) deals with such defects and deviations of development as amentia, endocrine disorders, blindness, deafness, cerebral injury and environmental retardation. The information given in the chapters dealing with amentia should not only be valuable to those medical officers who are called upon to ascertain the mentalities of young children, to whom the standard intelligence tests are hardly applicable, but also to paediatricians and others in preventing them from raising false hopes in the minds of the infants' parents.

Particularly interesting chapters are those entitled "Environmental Retardation" and "Clinical Aspects of Child Adoption". The former chapter discusses the importance of environmental factors and shows how any such factors that are adverse may lead to behaviour impoverishment which may be mistaken for unsubstantial hereditary endowment. It is a chapter which might advantageously be read by those responsible for Institutions for children.

The chapter on child adoption refers to the potential hazards both to the children concerned and their foster-parents, which hazards can largely be avoided by appropriate placing. Both over-placement and under-placement can be harmful. In this connexion the authors state that when the question is asked "Is it safe to adopt an infant?" the reply might well be "Safe for whom?" Several interesting cases are quoted to illustrate the important matters discussed in these chapters.

The book, which is an interesting one, contains a fund of information which is made most readable and vivid as a result of



the inclusion of a number of illustrative cases. It can well be recommended as a notable contribution towards the subject of clinical paediatrics.

R. Gamlin

### 1343 Psychotherapy in Child Guidance

Gordon Hamilton. New York: Columbia University Press; London: Geoffrey Cumberlege, Oxford University Press, 1947. xxii + 340 pages. 22 x 14 cm. £1 2s. [£1.1]

(i) Clinically oriented social casework; (ii) the diagnostic process in child guidance; (iii) the child who acts out his impulses; (iv) the anxious child; (v) the severely disturbed child; (vi) direct treatment in the therapeutic process; (vii) the therapeutically conditioned environment; (viii) treatment of young children; (ix) treatment of the older child; (x) treatment of adolescents; (xi) treatment of the family; (xii) preparation for psychotherapy in social work. Bibliography. Index.

The essential feature of child guidance is team-work whereby several specialists in different disciplines bring their combined knowledge and experience to bear on a child's behaviour problem, evaluate its causation and significance and formulate a programme of treatment. At its best such team-work produces results that cannot be equalled by any other method. At its worst it is a disjointed and discordant mixture of views and opinions where there is failure in harmonious integration.

In *Psychotherapy in child guidance* Professor Gordon Hamilton gives an excellent account of the evolution of child guidance as practised in the Clinic of the Jewish Board of Guardians in New York, who have solved the problems arising in team-work by giving the social worker the role of psychotherapist. The question formulated in the foreword by Dr. Ackerman, "Why does the caseworker assume the role of therapist, rather than the psychiatrist himself?" is nowhere answered; but one feels that the psychoanalytic orientation of this group of workers provides the key.

Although the "ivory-tower" psychology of the psychoanalyst is stated to be outdated, problems of co-operation and of group tensions arise constantly amongst psychoanalytic workers. There will be many who will disagree fundamentally with the approach and technique that Professor Hamilton outlines, but nevertheless the book, which is provocative and stimulating, should be widely read. Besides the specific contributions made to the practice of child guidance there is a great deal of valuable case material and sound common sense on the different needs of children and adults in the treatment situation. Because the child cannot by himself alter his environment, he must look to adults for assistance. Consequently "direct psychological treatment and environmental modification must remain two aspects of a single effort in helping children".

As one would anticipate, environmental factors are given proper weight throughout the book: "There is no substitute for income, housing, food, and shelter, and there is no therapeutic substitute for family relationships... 'Affect hunger' is as crippling as is starvation of the body." It would be invidious and unfruitful to select for quotation one more than another part, but the shrewd and practical comments which intersperse clinical accounts of cases illustrate the wide basis of experience upon which the theory is built.

Psychosomatic problems are given due weight, and while here and there constitutional factors, particularly as limitations, are stressed, they are for the most part underrated owing to the psychoanalytic bias in interpretation. On the other hand a bald statement that "the psychoneurotic... is always a sensitive child" requires qualification.

There is a timely warning against too much deep psychotherapy. "Insight", Professor Hamilton reminds us, "may not only be unsuccessful but may easily prove harmful". Stress is laid appropriately on the importance of dealing with the family as a whole, with full awareness of the tensions between parent and child:

... the family dynamics must be not only understood but also utilized in treatment... with one worker or two, as needed... The family situation in which the behavior is being manifested is the central social fact to be accepted... In child guidance... the past is active in the immediate present in a special way.

Professor Hamilton ends by giving some necessary warnings concerning the training required by a social worker who is to employ psychotherapy:

Training for psychotherapy in social work does not have the objective of training the worker to be a lay analyst, but to use the principles of psychoanalytical psychiatry in a social context... Not all competent case-workers will have interest in or aptitude for psychotherapy, so that careful

screening and vocational guidance are essential... There is no substitute for liking children and having a natural skill with them.

There is a useful, if predominantly American, bibliography and a well-documented index. The book may be recommended to all those associated with child guidance work, but more particularly to the experienced and the critically minded.

Alan Maberley

### 1344 Psychiatric Interviews with Children

Edited by Helen Leland Witmer. New York: The Commonwealth Fund; London: Geoffrey Cumberlege, Oxford University Press, 1946. vii + 443 pages; 6 illustrations. 26 x 17 cm. £1 5s. [£1.25]

Part I. Introductory comments. Part II. The cases. Part III. Comments in conclusion.

The outstanding difficulty in psychological medicine, particularly with regard to psychotherapy, is the impossibility of conveying the nature of a psychiatric interview. Attempts have been made to record such interviews by dictaphone and similar mechanisms, but they all seem to fail because they tend to flatten out all the emotional interplay which must be of the very essence of an interview of this kind. Nevertheless, this volume has great value in so far as it attempts to get the essence of the interview with the child in such a way as to reconstruct the contact existing between the physician and the child over a long period of time.

We must, however, make one qualification in speaking of psychotherapy or child analysis in connexion with the volume before us. The technique of treatment as practised by the participants in this work is a part of the evolution of the team method known as child guidance. This technique, in which the team, consisting of a psychiatrist, a social worker and an educational psychologist, work together in the elucidating of a given case, developed slowly but inevitably from the work of American psychologists. Starting with Adolf Meyer, the American school realized that psychiatry was a dynamic study and not an analysis of cold, intellectually constructed entities. Meyer's work underwent further and most significant developments with the acceptance of Freud's fundamental theories. It was now possible not only to see the patient, and particularly the child, as a product of inheritance and environment, but to see also that the patient was a world in himself of conflicting emotions attempting the work of adaptation to reality. It soon became evident that the understanding of the child could be made complete only by studying him in terms of his own language, the language of play. But even that alone was not sufficient to deal with the multitude of problems in family life, in which the child was not only the maker of his own neurosis, but was aided and abetted by the parents themselves. Child guidance technique is illustrated in this volume as an attempt to amalgamate the analysis of the child with the guidance of the parents. The method of handling parents has itself changed in the last twenty years. At first an effort was made to make the parent change the conditions of the child's life, but the more it became clear that the parents' psychological problems were in part responsible for the child's problems, the more inevitable it became that the interview with the parents by the social worker was itself at the very frontiers of therapy. Such discoveries, therefore, that the social worker makes, can now be utilized on the same psychological level as the discoveries that the psychologist makes with the child.

This volume has contributions from some of America's most distinguished child psychiatrists: Frederick Allen, Phyllis Blanchard, Lydia Daves, Hyman Lippman, Martha MacDonald, Beata Rant & Robert Young. Although one cannot but rest unsatisfied with these excerpts from interviews, a brave attempt has been made to bring to the reader the close interpersonal relationship which they set up in the course of the treatment, and also the close relationship which the clinic team always maintains between its members and the parents and the child. The volume is essentially a set of human documents, and although we cannot, and possibly ought not to expect clarified psychological concepts in each case, the writers of each section do bring to life the actual child, and this is perhaps as much as we can ask. Another type of book would be necessary for the detailed exposition of theories of the child's mental dynamics, but this would be scientific and less human, whereas this volume is human and does not claim to create a science.

Emanuel Miller

## CLINICAL MEDICINE

## 1345 The Background of Therapeutics

J. Harold Burn. London: Geoffrey Cumberlege, Oxford University Press, 1948. vi + 367 pages; 58 figures. 22 x 14 cm. £1 2s. 6d. [£1.125]

(i) Systems of medicine; (ii) reflex centre; (iii) the thyroid and thioracil; (iv) the anaphylaxis and histamine; in syphilis; (viii) the malar aggranulocytosis, and folic acid; (x) iron and calcium; (xi) plasma protein and the liver. Oedema and digitalis; (xii) the steroid hormones; (xiii) acetylcholine in skeletal muscle. Myasthenia gravis; (xiv) advances in neurology; (xv) analeptics, including pressor agents; (xvi) theories of anaesthetic action; (xvii) alloxan diabetes; (xviii) statistics explained. Index.

In the chain which connects laboratory science and clinical medicine the weakest link is often that between laboratory and clinical research. Professor Burn has succeeded in strengthening this link by producing a book which illustrates the application of laboratory investigation and scientific principles to the treatment of disease. He stresses the great importance of patient investigation under carefully controlled conditions in the laboratory as a prelude to research work in the clinical field; but it is doubtful whether clinicians would entirely agree with his dictum that two to five years' training in a laboratory is an essential prelude to clinical investigation. Clinical acumen, which is indispensable to the clinical research worker, is a quality which is not automatically conferred by pure scientific ability, and cannot be acquired without years of clinical experience and practice. Perhaps the nearest approach to the ideal method would be for the clinician to spend some part of every working day in laboratory work in addition to clinical work.

The book covers many aspects of therapeutics and each chapter has been cleverly arranged to illustrate the application of non-clinical research to the problems of clinical medicine. A few criticisms may, however, legitimately be made. In discussing the use of thioracil compounds the author states that patients with nodular goitres respond less well than those with primary thyrotoxicosis. Although this statement was made by more than one authority in the early days of thioracil therapy, many workers now agree that patients with nodular goitres respond as well as those with primary thyrotoxicosis, if not better. In Chapter IV, local chemotherapy is discussed at length, but no mention is made of the value of systemic chemotherapy in the treatment of infected wounds and burns, or of the danger of sensitization to sulphonamide compounds and the production of penicillin-resistant organisms when local application is used. The mode of action of anaphylaxis and of antihistamine substances is fully discussed in Chapter V; therapeutic trials have now, however, thrown more light on the clinical application and limitations of the latter. Professor Burn rightly sounds a note of caution in the use of amphetamine in the treatment of obesity, but in the opinion of the reviewer the doses suggested are too high. It is doubtful if more than 10 mg. daily should ever be given, and higher dosage is not likely to be more effective. This drug should never be given to patients with moderate or severe hypertension.

The effectiveness of folic acid in restoring to normal the blood picture in patients with megaloblastic anaemia is well described in Chapter IX. Initially it was thought that folic acid would supplant liver extract in the treatment of pernicious anaemia but, as we have found from clinical follow-up studies, the former agent fails to arrest sub-acute combined degeneration of the spinal cord, and may even exacerbate this condition. The story of folic acid illustrates admirably the importance of integrating scientific research with clinical observation.

In view of recent statements that digitalis acts in congestive heart failure by lowering venous pressure, many clinicians will welcome Professor Burn's emphasis on its action in increasing the force of contraction of heart muscle, and depressing conductivity. There is, however, little clinical advantage in using strophanthin rather than digoxin for rapid intravenous therapy.

The treatment of Addison's disease by implantation of desoxycorticosterone acetate (DOCA) into the subcutaneous tissues is mentioned in Chapter XII and a figure of 375 mg. is quoted for a single implantation. This dosage is dangerous, and the reviewer has seen hypertension with left ventricular failure occur in a patient whose implant was increased from 100 mg. to 200 mg. Calculations based on the daily requirements of injected DOCA and the amount of DOCA supposedly provided

daily by the implant are probably entirely fallacious, and increasing the size of the implant does not materially increase or prolong its effectiveness.

One of the best chapters is that which deals with myasthenia gravis, curare, and the transmission of nervous impulses to muscle. There is also a useful chapter on statistics and a fascinating account of various systems of medicine.

This is a most important book because, apart from the valuable information which it contains, it emphasizes the mutual interdependence of the research physiologist, pharmacologist, and clinician. Professor Burn is to be congratulated on writing so lucid and readable a work, which should be read by all who practise and teach clinical medicine.

J. F. Goodwin

## 1346 Progress in Clinical Medicine. By Various Authors

Edited by Raymond Daley & Henry G. Miller. London: J. & A. Churchill Ltd., 1948. xi + 356 pages; 22 text-figures; 15 plates. 24 x 16 cm. £1 1s. [£1.05]

(i) The control of infections; (ii) venereal diseases; (iii) tropical medicine; (iv) gastro-intestinal disorders including liver diseases; (v) metabolic disorders; (vi) cardiovascular diseases, (vii) renal diseases; (viii) diseases of the blood; (ix) diseases of the chest; (x) diseases of the nervous system; (xi) endocrine disorders; (xii) psychosomatic medicine; (xiii) the chronic rheumatic diseases. Index.

This volume is the work of a group of specialists, each with wide experience in his chosen field; its purpose is to give an authoritative account of the major developments of the last few years. The articles include a select list of references to the current literature, which should be of considerable value. On the whole, the authors have succeeded admirably in their purpose.

A review of penicillin is welcome since it includes a short but comprehensive account of the position with regard to aerosols, whereas the account of the subject of streptomycin must necessarily be already a little out of date by the time the reader is reached. The position of penicillin in venereal disease is authoritatively discussed and a method of treatment recommended. The standing of mepacrine and paludrine in anti-malarial therapy is reviewed, and the modern treatment of the dysenteries and parasitic infections given. Avery Jones, in dealing with gastrointestinal disorders, describes in masterly fashion the oft-neglected subject of oesophageal hiatus hernia and then goes on to a review of the present standing of gastroscopy, in which its advantages and drawbacks are clearly outlined. Less might well have been written on ulcers in a work of this type, whereas the summary of the vast literature on gastrointestinal bleeding and its treatment will be welcome to most readers. George A. Smart reviews disorders of metabolism, devoting most of the space to the subject of diabetes. The chapter on cardiovascular disease deals with several fairly recent advances, such as the surgery of congenital heart disease, but fails to mention the important advances made with the aid of the cardiac catheter or modern methods of electrocardiography. Renal and blood disorders are reviewed, and in the chapter on the latter, Martin C. G. Israëls gives a welcome list of the indications for the performance of sternal marrow puncture. Modern trends in the treatment of pulmonary tuberculosis are described. A discussion on intervertebral discs and electroencephalography, amongst other subjects, are dealt with in a chapter on nervous diseases. An excellent chapter on psychosomatic medicine, perhaps the best part of the book, with a comprehensive analysis of recent work in this field, is written by Henry G. Miller, while two short chapters are devoted to the fields of endocrinology and rheumatology.

This book is certainly one of the better of the symposia which aspire to introduce the specialist to advances in fields of medicine other than his own.

G. Loewi

## 1347 The Modern Management of Gastric and Duodenal Ulcer

Edited by F. Croxon Deller. Edinburgh: E. & S. Livingstone Ltd., 1948. 227 pages; 57 figures. 23 x 16 cm. £1

(i) Applied anatomy and physiology; (ii) pathogenesis; (iii) clinical pathology; (iv) symptoms; (v) clinical examination; (vi) special investigations: (a) radiology

(b) gastric analysis (c) occult blood test (d) gastric aspiration (e) gastroscopy; (vi) differential diagnosis; (vii) the diagnosis of the complications of gastric and duodenal ulcers; (ix) the diagnosis of malignancy; (x) the decision on treatment; (xi) strict medical therapy; (xii) the indications for surgical treatment; (xiii) the surgical operative details; (xiv) the complications of operations for gastric and duodenal ulcer; (xv) anaesthesia for gastric operations; (xvi) details of ancillary diagnostic methods. Epilogue. References. Index.

The editor of this monograph writes in the "Epilogue" that, in the treatment of gastric and duodenal ulcer, "Team-work is essential." The volume is evidently a reflection of such team-work in practice, for the five specialist contributors, like the editor, are members of the staff of Southend General Hospital. The editor and Dr. R. Sleight Johnson deal with the medical aspects, Mr. Rodney Maingot and Mr. A. K. Monro write the surgical chapters, the section on radiological diagnosis is by Dr. H. C. H. Bull, and that on anaesthesia is by Dr. J. Alfred Lee. The result stands as a vindication, if any is needed, of the value of team-work in the handling of this difficult problem.

All aspects of the subject are considered, including anatomy, physiology, pathology, radiology and anaesthesia, but the emphasis lies on the clinical problem and the whole is presented essentially for the clinician, who will find it both readable and educative whether he be general practitioner, physician or surgeon. The work is throughout practical, including for example precise details of techniques of investigation, of alternative diets for medical therapy, and of the operative methods advised. There is, however, no over-simplification of the problem and the difficulties are presented and discussed in a helpful way.

The epithet "modern" in the title proves to be justified and this fact will increase the value of the book to those clinicians who find it difficult to keep pace with the current output of papers on peptic ulcer in the journals. There is, for example, a description and balanced estimate of the operation of vagotomy.

The volume fills the present need for a review of its subject so well that criticism would be out of place, but the omission of description and discussion of the methods of estimating the night secretions of the stomach may be regretted. It is to be hoped that some mis-statements of fact will be corrected in another edition, as that *enterogastrostomy* is a stimulant of gastric secretion (p. 12) or that: "Anatomically, the lesser curvature differs from the remainder of the stomach in that it bears the acid-producing mucosa . . ." (p. 45).

The book attains a high standard of production and illustration, and includes a useful list of references and an index.

A. G. R. Lowdon

### 1348 Hodgkin's Disease and Allied Disorders

Henry Jackson & Frederic Parker. New York: Oxford University Press; London: Geoffrey Cumberlege, 1947. x + 177 pages; 15 plates. 29 x 19 cm. £2 5s. [£2.25]

(i) Hodgkin's disease: 1. History, etiology, incidence. 2. Pathology. 3. Symptoms and course. 4. Involvement of certain organs. 5. Involvement of certain other organs. 6. Clinical diagnosis. 7. Treatment and prognosis; (ii) reticulum-cell sarcoma: primary in bone; (iii) lymphocytoma and lymphoblastoma; (iv) lymphosarcoma; (v) giant-follicle lymphoma; (vi) plasmacytoma; (vii) endothelioma. Index.

This monograph is a combined clinical and pathological study of a large series of personal cases of Hodgkin's disease, together with an exhaustive and instructive discussion of every aspect of the disease. There are shorter descriptions of the related primary lymphadenopathies which accentuate the well-recognized clinical and pathological individuality of Hodgkin's disease itself and are of value in its differential diagnosis.

The nomenclature used in the description of Hodgkin's disease will be somewhat strange to English readers. It is based on two assumptions: first, that the pathological background of Hodgkin's disease is a reactive inflammatory hyperplasia of mesenchyme to an unknown infective agent—for this reason the lesion is described as a granuloma; second, that this process may take on all the characteristics of a destructive and infiltrating sarcomatous growth which, as it clearly arises on the basis of the granulomatous lesion, should be called "Hodgkin's sarcoma". The evolution of the fully developed granuloma with visceral involvement is said to have two distinct phases, "Hodgkin's paraneoplasia" and "Hodgkin's granuloma", the former describing

the period usually called "early Hodgkin's disease", in which only the peripheral glands and spleen are involved, the latter being used for the period when the disease becomes generalized and the liver, bone marrow, skin, lungs and bowel strongly tend to be affected. The term "Hodgkin's paraneoplasia" is considered to be preferable to "early Hodgkin's disease" in that this stage often has a duration of several years, in exceptional cases up to ten. The term "lymphoma" is used freely in describing some of the other primary lymphadenopathies. This confusion of terms will persist, and is likely to become still more confusing as long as these diseases are described on a basis of histological structure and until we gain more precise knowledge of their etiology. Meanwhile the position calls for the exercise of patience and tolerance. In the case of this monograph the reader will quickly grasp what the authors mean by "Hodgkin's paraneoplasia", and having translated this into his own nomenclature he will certainly profit by the accounts of their experience and their clearly written and critical discussions. On the other hand, the reader may belong to the school which some time ago cast "Hodgkin's sarcoma" into the outer darkness. He should read this monograph and decide for himself, on the evidence submitted, whether this was justifiable.

C. Hodfield

### 1349 Jaundice: its Pathogenesis and Differential Diagnosis

Eli Rodin Movitt. New York: Oxford University Press; London: Geoffrey Cumberlege, 1947. xvi + 261 pages; 23 figures; 2 colour plates. 24 x 16 cm. £2 2s. [£2.1]

Part I. (i) The anatomy of the liver and the biliary tract; (ii) the physiology of the liver; (iii) the metabolism of the bile pigment; (iv) the pathogenesis of jaundice; (v) diagnostic procedures; (vi) differential diagnosis of jaundice—general principles. Part II. (vii) Hemolytic jaundice; (viii) parenchymatous jaundice—acute and subacute hepatitis; (ix) parenchymatous jaundice (continued)—chronic hepatitis. Carcinoma; (x) obstructive jaundice. Appendix. Index.

This book is intended as a practical text for the general physician and the gastro-enterologist. In many ways, however, it fails to fulfil this purpose. As indicated by the title the scope is limited to the pathogenesis and differential diagnosis of jaundice. Much important recent work on the liver, is, therefore, omitted. In particular the relation of diet to diseases of the liver and the valuable contributions to hepatic physiology by hepatic venous catheterization are not included. Treatment is not mentioned. The text does not seem full enough to satisfy the present need for an up-to-date reference book of liver diseases, neither is it concise enough to be used as a students' manual.

The book is divided into two parts. The first part deals with the anatomy and physiology of the liver along the usual textbook lines. There is little attempt at critical evaluation of the statements included. As the book deals specifically with jaundice, the author's opinion on the Van den Bergh reaction and its limitations and the relation between direct and indirect bilirubin would be welcomed.

The second part is devoted to largely clinical descriptions of the various diseases giving rise to icterus. These accounts will be in the main helpful to the clinician; they are very readable. However, in this section also there are grounds for criticism. The outmoded term "catarrhal jaundice" is retained in the chapter on parenchymatous icterus. Possible syringe contamination by the causative virus is not included in the etiology of the jaundice occurring during arsenotherapy for syphilis. The table (p. 182) which attempts to distinguish between epidemic and homologous serum jaundice is rather optimistic.

References to the literature are included at the end of each chapter. However, in the text, the authors are rarely mentioned by name. As the titles of the papers are not quoted this makes further study by the reader very difficult. The American literature is well covered up to the date of publication (1947). References to European work are scanty.

The book is well produced; misprints are few. In view of the present shortage of books on the liver it is unfortunate that it cannot be more enthusiastically recommended.

Sheila Sherlock

## DENTAL SCIENCE

### 1350 Oral and Dental Diseases: Aetiology, Histopathology, Clinical Features and Treatment. A Textbook for Dental Students and a Reference Book for Dental and Medical Practitioners

Hubert H. Stones. Edinburgh: E. & S. Livingstone Ltd., 1948. xix + 896 pages; 926 illustrations. 25 x 18 cm. £4 10s. [£4.5]

(i) Congenital malformations of the jaws and associated parts; (ii) the effects of endocrine disorders on the development of the jaws and teeth; (iii) the effects of nutritional deficiencies on the teeth and jaws; (iv) osteodystrophies involving the jaws; (v) eruption and resorption of the deciduous dentition: associated pathological conditions; (vi) eruption of the permanent dentition: associated pathological conditions; (vii) anomalies in number, size and form of the teeth; (viii) abnormalities of structure—hypoplasia; (ix) malocclusion of the teeth and maldevelopment of the jaws; (x) traumatic occlusion. Functionless teeth. The width of the periodontal membrane; (xi) attrition, abrasion and erosion of the teeth; (xii) the effects on the dental tissues of procedures used in operative dental surgery; (xiii) injuries to the teeth due to violence; (xiv) the aetiology of dental caries; (xv) bacteriology of dental caries; (xvi) the histopathology and clinical features of dental caries; (xvii) reparative and regressive processes in the dentine and pulp; (xviii) bacteriology, inflammation, necrosis and gangrene of the pulp; (xix) acute local periodontitis and acute periapical abscess; (xx) chronic local periodontitis, periapical granuloma and chronic periapical abscess; (xxi) resorption of the teeth; (xxii) cementum: abnormalities associated with its formation; (xxiii) acute infections of the face and neck that may be of oral causation: abscess and cellulitis; (xxiv) saliva; (xxv) calculus; (xxvi) stains and discoloration of the teeth; (xxvii) bacteriology of the mouth and of chronic gingivitis and parodontal disease; (xxviii) chronic gingivitis and parodontal disease (periodontitis); (xxix) stomatitis and allied diseases of the oral mucosa; (xxx) stomatitis and allied diseases of the oral mucosa (*continued*); (xxxi) stomatitis and allied diseases of the oral mucosa (*continued*); (xxxii) stomatitis and allied diseases of the oral mucosa (*continued*); (xxxiii) chronic oral sepsis and its relation to systemic diseases. Focal infection; (xxxiv) inflammation of the maxillary sinus. Involvement during dental operations; (xxxv) periostitis, osteomyelitis and necrosis of the jaws; (xxxvi) traumatic maxillo-facial injuries; (xxxvii) inflammatory lesions of the mandibular joint; (xxxviii) neuralgia; (xxxix) cysts of odontogenic origin. Composite and connective tissue odontomata; (xl) oral inclusion cysts; (xli) oral tumours; (xlii) diseases of the salivary and oral mucous glands. Author index. Subject index.

Other publications have dealt with diseases and injuries of the teeth and their investing tissues, the oral mucosa and the jaw. Few recount so lucidly the etiology, histopathology and clinical characteristics of the lesions considered or explain, as this does, how rational therapeutic measures may be based on a sound understanding of the nature of the injuries and diseases which the dental surgeon may encounter. A feature of this new textbook, which is intended for dental students and for dental and medical practitioners, is the number of excellent illustrations, which include a wealth of photomicrographs as well as monochromatic and coloured clinical photographs. Especially valuable are the references to more recent research both in this country and elsewhere, while the balanced views afforded on controversial issues will assist those who find the conflicting evidence and opinions on some aspects of oral pathology bewildering. The admirable chapters on periodontitis and gingivitis and on traumatic maxillo-facial injuries will be found particularly helpful, as will those on cysts, tumours and diseases of the oral mucosa. Especially commendable is the consideration given to the effects of everyday operative procedures, which have not been crowded out by the more obscure although picturesque rarities. In compiling this textbook, which we are confident will be of the greatest use to both student and practitioner, the author has drawn on his own extensive experience both as teacher and clinician and has embodied much of his own research. His broad conception and sound pathological approach materially enhance the value of a work which will be, we are certain, warmly received.

The book is well printed and presented; the text is both concise and comprehensive.

R. V. Bradlaw

## DERMATOLOGY

### 1351 Modern Trends in Dermatology

Edited by R. M. B. MacKenna. London: Butterworth & Co. Ltd., 1948. xiv + 432 pages; 32 figures. 25 x 17 cm. £2 2s. [£2.1]

(i) The dermatology of yesterday, to-day, and to-morrow; (ii) the anatomy of the skin; (iii) physiology and functional pathology of the skin; (iv) dermatology

and nutrition; (v) the biochemistry of skin; (vi) the influence of the sex hormones on the skin and pilosebaceous system, with a discussion of the aetiology of 'seborrhoeic' eruptions; (vii) bacteriology; (viii) the autogenous disinfection of the skin; (ix) parasitology in relation to dermatology; (x) mycology in relation to dermatology; (xi) psychological aspects of dermatology; (xii) occupational dermatoses; (xiii) dermatological problems in tropical and sub-tropical areas; (xiv) necrobioses, atrophies, scleroses, infiltrations and accumulations in the skin; (xv) the prevention of cutaneous diseases, excluding modern trends in therapy; (xvi) the rehabilitation of cutaneous disease; (xvii) on the use of statistics.

For this symposium the editor has gathered contributions from both sides of the Atlantic, and furthermore dermatologists are outnumbered two to one. Consequently the outlook on the various aspects of the specialty is wide, which is right and proper; for, as F. A. E. Crew says in his chapter on the prevention of cutaneous diseases, excluding industrial maladies, "The plain fact is that the dermatologist must either be much more than a skin specialist or else find neither satisfaction nor serenity in his vocation." The first chapter, on the dermatology of yesterday, today and tomorrow, reflects the wide-ranging vision of J. H. Stokes, always a potent stimulator of thought.

The chapter on anatomy incorporates the newer knowledge which has been acquired through experimental methods, a modern trend in a subject so long static; while the complementary one on physiology and functional pathology shows that there is still much to be ascertained in this field. The article on nutrition deals mainly with the vitamins and the one on biochemistry outlines the action of enzymes on the skin. Parkes Weber's article on necrobioses, atrophies and scleroses also has mainly biochemical connexions. Although biochemistry has established relations with dermatology for a much shorter period than have bacteriology, mycology and parasitology, it is the chief modern trend in dermatology; but these other subjects also have their latest advances satisfactorily correlated here.

Psychosomatic medicine is represented by articles on the psychological aspects of dermatology and on rehabilitation. Earlier in the book the reader will note the following warning: "Care must be taken, therefore, before ascribing a person's physical symptoms wholly to his psychological state, since the latter may well depend upon a metabolic error, the correction of which may completely change his mental outlook."

This book, intended for dermatologists and senior students of dermatology, is the most interesting one on the subject that has appeared in the last decade. The non-dermatologist will also find much to interest him, and the book will certainly dispel any long-rooted prejudices that the specialty is merely an affair of peddling lotions and ointments. It is a pleasure to find that overworked term allergy reduced to its proper perspective; on the other hand it is astounding to find no reference in the index to itching or pruritus, nor is this condition dealt with under physiology or functional pathology.

As the majority of articles are written by those not specializing in skin diseases, dermatologists will naturally find a few statements with which they disagree, but they will be thankful to have this book. They must read, re-read and ponder on it.

G. W. B.

### 1352 The Skin Diseases. A Manual for Practitioners and Students

James Marshall. London: Macmillan & Co. Ltd., 1948. xi + 363 pages; 214 figures. 22 x 14 cm. £1 10s. [£1.5]

(i) Anatomy and physiology of the skin; (ii) pathological changes in the skin; (iii) symptomatology of skin diseases; (iv) diagnosis; (v) principles of treatment; (vi) congenital abnormalities; (vii) physical dermatoses; (viii) the infectious fevers; (ix) pyogenic infections; (x) bacillary infections; (xi) syphilis; (xii) acquired syphilis (primary stage); (xiii) acquired syphilis (secondary stage); (xiv) acquired syphilis (tertiary stage); (xv) prenatal or congenital syphilis; (xvi) treatment of syphilis; (xvii) cutaneous tuberculosis; (xviii) lupus erythematosus; (xix) diseases due to viruses; (xx) diseases due to animal parasites; (xxi) diseases due to fungi; (xxii) the papulo-squamous eruptions; (xxiii) toxic dermatoses of epidermal origin; (xxiv) toxic eruptions of dermal origin; (xxv) drug eruptions; (xxvi) psychological aspects of skin diseases; (xxvii) pruritus, neurodermatitis, dyshidrosis and prurigo; (xxviii) dermatoses of vascular origin; (xxix) atrophies and degenerations; (xxx) reparatory disturbances; (xxxi) hyperkeratoses, dyskeratoses and hyperplasia; (xxxii) vitamin deficiency diseases; (xxxiii) diseases of the cutaneous appendages; (xxxiv) tumours of the skin. Index.

This manual is designed for students and is written simply and practically. Whilst emphasizing the commoner conditions, it attempts to cover the whole field of dermatology, but the value of cursory references to numerous rarities in a book of this type is doubtful. The chapter on diagnosis contains a topographical



list of diseases, illustrated by diagrams which are very helpful to the beginner, and the chapter on treatment is clear, with simple but adequate prescriptions. It is not, however, very practical to advise penicillin, given every three hours, day and night, to a total of 60-80 injections, for furunculosis.

The best section both for matter and for illustrations (except for histological ones) is that on syphilis, which is obviously based on the author's own wide observation and experience in treatment. The present reviewer approves of the inclusion of chapters on infectious diseases and on the psychological aspect of skin disease. There are numerous statements to which exception might be taken; these concern the use of radium for port-wine stains, the necessity for disinfection of the clothes after benzyl benzoate treatment of scabies, the hourly spraying with penicillin in impetigo, and the dosage of 50 mg. of benadryl every four hours for urticaria, etc. There is also no mention of elastoplast in the treatment of gravitational ulcers. Despite these criticisms, the general practitioner will find this a useful and understandable book.

F. F. H.

## ENDOCRINOLOGY

### 1353 Major Endocrine Disorders

S. Leonard Simpson. Second edition. London: Geoffrey Cumberlege, Oxford University Press, 1948. xxii + 552 pages; 89 figures. 22 x 14 cm. £2 2s. [£2.1]

Section I. The pituitary: A. Physiology. B. Clinical. Section II. The adrenals: A. Physiology. B. Clinical. Section III. The thyroid: A. Physiology. B. Clinical. Section IV. The parathyroids: A. Physiology. B. Clinical. Section V. The gonads: A. Physiology. B. Clinical. Section VI. The pancreas: A. Physiology. B. Clinical. Appendices. Reference index.

There seems to be a grim determination in the minds of publishers and authors to make ordinary readers, what is termed in America, "endocrine conscious". There have appeared recently quite half a dozen works on clinical endocrinology and Dr. Leonard Simpson's *Major endocrine disorders* now reappears after ten years, as a second edition. The most exhaustive work on clinical endocrinology is the book entitled *Klinisk endokrinologi* by Hermann Nielsen of Copenhagen. This work is in three volumes of which the first was published in 1938, the second in 1941, and the third in 1942. As the text is in Danish it is only of limited value and it is therefore with great interest that one takes up an English work which covers roughly the same field.

Dr. Simpson has used the space at his disposal very ingeniously and the book is certainly an essential as a reference work for anyone interested in this subject. It is obvious to the reader that Dr. Simpson is mainly interested in the purely clinical aspect. His descriptions and illustrations are very good; he has also taken great trouble in most cases to read and present to the reader the original descriptions of the diseases.

If one were to criticize, one would like to have seen a more detailed account of the physiology and biochemistry of the endocrine glands and of their products. One cannot help feeling that the reader who did not possess fairly good knowledge of these matters would find Dr. Simpson's descriptions rather meagre. To give a specific example: the reviewer was unable to find any clear-cut description of what is really meant by 17-ketosteroids. One can imagine that many general physicians will turn to such a book as this with the hope of finding an explanation of this familiar term. If one looks in the index, one finds references to excretion of 17-ketosteroids in various conditions, but there is no statement as to what they are or how they are determined, and so forth. Let us hope that Dr. Simpson in a future edition will devote a section of his book to a description in simple language of the more technical side of the subject for the general reader.

If he were asked to pick out the best chapter, the reviewer would mention in particular the one on the adrenals. Here the author has given a concise and clear picture of this extremely difficult subject; he has described adrenal physiology and biochemistry in some detail, thus enabling the reader to appreciate fully the very excellent summary of the clinical applications of this knowledge.

E. C. Dodds

### 1354 Endocrinology of Neoplastic Diseases. A Symposium by Eighteen Authors

Edited by Gray H. Twombly & George T. Pack. New York: Oxford University Press; London: Geoffrey Cumberlege, 1947. vi + 392 pages; illustrations. 24 x 16 cm. £3

(i) Tumors in experimental animals receiving steroid hormones; (ii) experimental investigations concerning the role of the pituitary in tumorigenesis; (iii) the endocrine effects of pituitary tumors; (iv) ovarian tumors with sex hormone function; (v) endocrine factors in the origin of tumors of the uterus; (vi) the relationship of hormones to diseases of the breast; (vii) the effect of sex hormones on skeletal metastases from breast cancer; (viii) benign hypertrophy and carcinoma of the prostate; (ix) the endocrine treatment of cancers of the prostate gland; (x) the relationship of hormones to testicular tumors; (xi) adrenal cortical tumors—physiologic considerations; (xii) hormonal tumors of the adrenal; (xiii) the endocrine activity of thyroid tumors and the influence of the thyroid hormone on tumors in general; (xiv) the endocrine aspect of enlargements of the parathyroid glands; (xv) hyperinsulinism in relation to pancreatic tumors; (xvi) the endocrinologic aspects of tumors of the pineal gland. Index.

It is never quite easy to review a book which has been written by many different individuals. In the present instance the task is somewhat simplified by the fact that every one of the eighteen contributors is a recognized authority on the subject about which he writes. The book is founded on a series of articles which first appeared in *Surgery* in 1944 and have since been revised and brought up to date. In the course of the sixteen articles of which the book is composed, consideration is given to: (i) the role of the pituitary in the causation of tumours, (ii) the neoplastic effects of certain hormones, (iii) the excessive production of hormones by some neoplastic tissues, (iv) the treatment of tumours by the administration of hormones, (v) the urinary excretion of hormones as an aid to the diagnosis of certain tumours. Organs which receive detailed attention are the pituitary, ovary, testis, mamma, prostate, adrenal, thyroid, parathyroid, pancreas and pineal body; and adequate consideration has been given to appropriate laboratory work performed on animals. One or two slips can be found in this as in any other symposium. For example the "nearly always" on line ten of page 215 may be compared with the seventeen out of twenty-five (68%) in lines 30, 31 of page 220. However, the lapses from unbroken perfection are negligible when the general excellence of the book is regarded; in fact some of the contributions, especially the one by Robert A. Moore on benign hypertrophy and carcinoma of the prostate, might be used as a model of the way in which surgical problems should be presented.

This is a first-class book, rich with information, and everyone interested in the subject with which it deals will find it indispensable.

Harold Burrows

## FORENSIC MEDICINE

### 1355 Taylor's Principles and Practice of Medical Jurisprudence. Volume I

Originally written by Alfred Swaine Taylor. Tenth edition edited by Sydney Smith, with a complete revision of the legal aspect by W. G. H. Cook and of the chemical aspect by C. P. Stewart. London: J. & A. Churchill Ltd., 1948. viii + 723 pages; 48 figures; 1 plate. 25 x 16 cm. £2 5s. [£2.25]

(i) Introduction; (ii) medico legal responsibility in the examination of the person alive and dead; (iii) constitution and functions of General Medical Council—malpractice; administration of anaesthetics: quackery: neglect; (iv) identification of living persons and human remains; (v) death: its signs and changes that take place in the body after death; (vi) apparent death: premature burial; (vii) general inferences to be drawn from a dead body apart from the cause of death; (viii) legal presumption of death and of survivorship; (ix) wounds and personal injuries (general); (x) the examination of blood stains; (xi) firearm wounds; (xii) death from lightning and from electrical currents; (xiii) deaths connected with cold and heat—spontaneous combustion: vitriol throwing; (xiv) starvation; (xv) asphyxial deaths—suffocation: drowning: strangulation: hanging; (xvi) suicide; (xvii) life insurance—general and accident: general life insurance; (xviii) insanity—general, and in relation to the law. Index.

This volume is essentially a book of reference, being too extensive for the undergraduate, and as such it enjoys an unchallengeable position in the realm of medicolegal literature. Eighty-three years have passed since Alfred Swaine Taylor first introduced his book and, despite the fact that he was responsible for only the 1st and 2nd editions, it is a great tribute to his subject-matter, and to the three editors who have since handled the work,



that it is still in demand. In some respects it is unfortunate that both volumes of the present edition could not be published simultaneously.

Professor Sydney Smith and Dr. W. G. H. Cook are to be congratulated on the present volume. Its arrangement has been altered, certain sections have been entirely rewritten, and a great deal of new material has been included. The chapters dealing with medicolegal responsibility in the examination of the person alive or dead, with malpraxis and medical negligence, and with asphyxial deaths, are particularly good.

English rather than Scottish law is emphasized throughout, and in this respect the book is somewhat less useful to the Scottish reader. It seems a little unfortunate that the arrival of the new edition, four years after its predecessor, could not have been slightly retarded in view of the advent of a considerable amount of new legislation with a medicolegal bearing. Such a course would have permitted inclusions and obviated the tendency to have the new book out of date from its start. The preface states, in relation to the National Insurance (Industrial Injuries) Act, 1946:

The new Act has been dealt with very briefly in its medico-legal applications, which is all that is possible or necessary at the present stage; it would seem, however, that many of the defects of the former legislation (Workmen's Compensation Acts) have been remedied.

The subject-matter relating to the Workmen's Compensation Acts occupies less than a page, and that relating to the National Insurance (Industrial Injuries) Act only 13 lines. Information regarding industrial diseases, apart from eight lines on their relation to the Workmen's Compensation Acts, appears to be entirely absent. It is also noted that the term "Certifying Surgeon" is adhered to, although this term has been replaced by the designation "Examining Surgeon".

The short account of dactylography is rather unsatisfying. One feels that this subject lies more within the province of the finger-print expert than of the medicolegal specialist; if it is to be dealt with at all in works pertaining to medical jurisprudence, this should be done with the assistance of an appropriate expert.

In dealing with the matter of the identification by examination of bones, the question of the overlap of male and female characters in the pelvis, an important and not infrequent finding, might have been discussed. The more recent work and views on the vagaries of the obliteration of cranial sutures also deserves mention.

The table on p. 410, giving the average sizes of blood corpuscles of different animals, could well have been omitted. While such matters may be of undoubted biological interest, serological tests have made them of little value in the identification of blood as a laboratory routine.

The paucity of illustration (48 figures and 1 plate in a volume of 723 pages), and their poor quality and unsuitability, is perhaps the greatest deficiency of this volume. Some chapters suffer particularly, the one on wounds being a notable example. The six drawings of fibres on p. 121, and the drawing on p. 403 representing haemin crystals, are hardly what one would expect to find in such a book; photomicrographs are almost universally employed and are far superior.

Despite these criticisms, the book as a whole is well balanced textually, has been authoritatively revised, and provides a mine of information, much of which is not to be found in the shorter textbooks. The legal aspects of the subject are clearly set out and the stamp of the expert is upon them. Those interested in medicolegal matters owe a debt of gratitude to the editor and to those associated with him for the painstaking task they have undertaken and performed so capably. This first volume of the 10th edition of Taylor can be confidently assessed as the best so far published.

John Glaister

## HISTOLOGY

### 1356 Gynaecological Histology

Josephine Barnes. London: Harvey & Blythe Ltd., 1948. xii + 242 pages; 162 figures. 22 x 14 cm. £1 10s. [£1.5]

(i) The body of the uterus; (ii) the cervix; (iii) the Fallopian tube; (iv) the ovary; (v) the vagina; (vi) the vulva; (vii) pregnancy. Index.

The author states that this book has been written with the object of providing a simple guide to the histology of the normal

and abnormal tissues encountered in gynaecological practice. This object has certainly been achieved. For senior students preparing for the final or postgraduate examination the book should prove very useful. The arrangement of the book is unusual but effective. The subject is divided into seven chapters: each deals with a particular part of the female genital tract, and contains a survey of the normal or pathological histology followed by illustrations, in fact photomicrographs, showing the appearances of the tissues described. Beneath each photomicrograph is a short but adequate account indicating the chief features. The subject matter is lucid, concise and matter of fact but nevertheless sound. There appear to be few important omissions.

In the chapter dealing with the endometrium of the uterine body, no reference is made to the mitoses which are found in the glands and stroma in the proliferative phase. The well-known decidual reaction in the stroma which occurs at the close of the premenstrual period and which is such a definite feature in many sections is not mentioned, though a brief allusion is made to it in the last chapter.

It is essential that in a book of this type the illustrations be good. There are 162 illustrations and most of them are good. Some of those dealing with the neoplasms of the ovary are excellent. There are, however, several which are not very convincing and could be replaced with advantage. Among these may be mentioned both the illustrations showing tuberculous endometritis and the one of carcinoma of the uterine body with squamous metaplasia.

This is an unusual but attractive book and there are many to whom it may prove very helpful.

J. Bamforth

## LACTATION

### 1357 Breast Feeding. A Guide to the Natural Feeding of Infants

F. Charlotte Naish. London: Geoffrey Cumberlege, Oxford University Press, 1948. viii + 151 pages; 20 figures. 19 x 13 cm. 10s. 6d. [£0.525]

(i) The mind of the mother; (ii) the physiology of lactation; (iii) ante-natal preparations; (iv) the first week; (v) the second week; (vi) 'the danger weeks' (3rd to 6th); (vii) established breast feeding. Appendix: The feeding of twins and triplets; (viii) weaning; (ix) breast trouble; (x) contra-indications to breast feeding and indications for weaning; (xi) breast feeding without suckling. Index.

This excellent little book is entirely practical in outlook and almost entirely practical in content; accounts of the theories involved are limited to the shortest necessary to give an understanding of events in lactation and breast-feeding.

It seems obvious that the natural way of feeding a child is likely to be the best, and statistics showing the incidence of gastro-enteritis and respiratory diseases most emphatically confirm the value of breast-feeding. The argument is sometimes heard that bottle-fed babies are those who are more weakly from birth and consequently more susceptible to disease; this has a small element of truth in it but it still remains likely that such infants would fare better if kept on the breast. The fact is, however, that breast-feeding is becoming less frequent in this country simply because an increasing number of mothers do not wish to carry it out.

Dr. Naish wastes no time in railing against social tendencies but attacks those problems that can be remedied immediately. She blames the doctor in many cases for failing to use his authority to keep the baby on the breast, when others, of whom the grandmother is a particularly frequent offender, are anxious to discredit the mother's efforts in order that by bottle-feeding they may obtain control of the child; incidentally, this unconscious desire is shown all too often by the nursing staff in hospital. In addition to this, surely, the doctor's failure has been that too little attention has been paid by the profession as a whole, to preparing the mother mentally and physically, from the first months of pregnancy, for feeding her infant. The author gives clear and exact instructions as to the management of breast-feeding; she describes the common causes of failure stage by stage and suggests what should be done to prevent and to remedy any faults, but early in the book emphasizes that adequate feeding is more important than entire breast-feeding for its own sake.

The whole account is brief, full of common sense and obviously written by someone who has a thorough knowledge of the subject and of the requirements of the people for whom the book was intended, as well as an understanding of the needs of mother and child.

There are a few points which it hardly seems fair to criticize, since they do not affect the practical advice given: but it is a little misleading to speak of the fatty consistency of colostrum, although the author's meaning is clear—and does the digestion of cow's milk really require more energy than the digestion of human milk?

This book is so useful that it is to be hoped that it will be possible to publish it later, not in the form of a textbook to be kept in libraries, but as a cheap paper-backed booklet which every medical student can be expected to buy, however short of money he may be; it must certainly be in the possession of all doctors and nurses who have charge of nursing mothers.

A. P. Norman

## MEDICAL PHILOSOPHY

### 1358 *The Harveian Oration: the Structure of Medicine and its Place Among the Sciences*

F. M. R. Walshe. Edinburgh: E. & S. Livingstone Ltd., 1948. 26 pages. 19 x 13 cm. 1s. 6d. [£0.075]

The Harveian Oration has been the occasion of many memorable utterances. Amongst these Dr. Walshe's philosophical discourse takes a high place. He is a master of the telling and arresting phrase, and is a powerful and persuasive advocate. His apology for "essay[ing] a theme so far transcending my capacity" will be dismissed summarily by his readers; rather will they look for a more detailed treatment from him of "those intellectual instruments and methods by which alone the confused data of our experience as physicians can be transmuted into a more or less coherent body of ordered knowledge", even though it disturbs the intellectual sloth of some of his contemporaries.

Harvey's work is used to illustrate the untenable dichotomy of the notions of observation and experiment, and art and science, except on the basis of arbitrary definitions. Dr. Walshe's treatment underlines Locke's statement that "every man has so inviolable a liberty to make words stand for what ideas he pleases, that no one hath the power to make others have the same ideas in their minds that he has, when they use the same words that he does." He stresses that Harvey's discovery of the circulation of the blood shows that there can be no fruitful experiment without reason. And he is (and what student of biology can fail to be?) a whole-hearted advocate of Smuts' holism! A Gothic cathedral is more than the sum of its individual stones, and man is greater than the sum of his systems, or tissues, or organs.

Dr. Walshe claims no originality for the topics he discusses; indeed, many of them are the common themes of texts on scientific method. But it is well that these should be restated on such an occasion and in so provoking a manner. This is not to suggest that the effort is beyond criticism. For example, when Dr. Walshe writes: "The process of observation is inextricably bound up with the entertainment of ideas, and with an emotional ferment that is felt as the subjective sense of importance, as interest, or what Quakers speak of as 'concern'", we sigh for the simplicity of language of Shakespeare, whose lover saw "Helen's beauty in a brow of Egypt." It would, moreover, be arguable that when Dr. Walshe regards "the clinician as passing the indeterminate frontier between observation and experiment when he devises a test to evoke signs in his examination"—e.g. eliciting a knee jerk—he himself falls victim to that unguarded use of abstraction and "false simplification" which he so rightly condemns. These minor criticisms, and each reader will name his own, do not detract from the merit of the work. Dr. Walshe has in earlier writings established his claim to a secure place amongst those who have contributed to the philosophy of medicine in our time. His Harveian Oration enhances his reputation in this neglected field.

Henry Cohen

## MEDICAL RESEARCH

### 1359 *Medical Research in War. Report of the Medical Research Council for the Years 1939-45*

Medical Research Council. London: His Majesty's Stationery Office, 1948. (Committee of Privy Council for Medical Research.) 455 pages. 24 x 15 cm. 7s. 6d. [£0.375]

Report of the Committee of Privy Council for Medical Research. Report of the Medical Research Council: (i) introduction; (ii) wounds and injuries; (iii) war diseases; (iv) therapeutics, including penicillin; (v) nutrition in war-time; (vi) personnel research; (vii) health research in industry; (viii) special emergency services; (ix) miscellaneous research and other activities supported or assisted by the Council during the war; (x) war publications; (xi) the National Institute for Medical Research; (xii) the preparation and maintenance of biological standards; (xiii) external research establishments and scientific staff; (xiv) research work aided by grants; (xv) postgraduate studentships and research fellowships; (xvi) conclusion. Index to subjects of research. Index to institutions. Index to personal names.

Because of war conditions, the Medical Research Council did not publish annual reports from 1939 to 1945. This volume remedies the deficiency and gives a very full account of the Council's activity during that critical period. The Council was called upon to give advisory and administrative assistance to various Government Departments and to the fighting Services in the application of the latest scientific knowledge to the practical conduct of affairs; they also directed and sponsored research devoted to solving those medical problems that were dictated by the urgencies of war. The present report reflects the way in which the whole activity of the Council was redirected along channels designed to yield direct contributions to the war effort. It is not surprising, therefore, to find that the research projects sanctioned by the Council were mainly concerned with practical problems rather than with basic scientific research.

The investigation of the properties of penicillin and the development of penicillin therapy was perhaps the most important project with which the Council was concerned. The work on penicillin<sup>1</sup> dates, of course, from its discovery by Sir Alexander Fleming in 1929, and the subsequent work done by Fleming, Florey, Chain and others. The Council, together with the Rockefeller Foundation of New York and the Nuffield Trust, contributed to the cost of a comprehensive programme of investigation at Oxford which was drawn up in 1939 before the war began. The advent of war greatly accelerated this programme: animal experiments were followed by clinical trials at Oxford and measures of the most vigorous kind were taken to bring penicillin into large-scale production, with the results that are now generally known. American collaboration, especially in the matter of production, was close and effective; the programme resulted in penicillin being available in the latter part of the war, in time to have a tremendous effect in reducing the mortality rate of casualties.

A large volume of work was accomplished in other fields. The practical problems of the treatment of war wounds, burns, traumatic shock, and head injuries were the subject of intensive investigation. The work of the War Wounds Committee was instrumental in assessing various modes of treatment and in establishing and standardizing treatment along the most effective lines.

Extensive work was also done by the Council on the problems associated with nutrition in wartime, rationing, accessory food factors, and nutrition in the Forces. Personnel research, especially related to the needs of the Army, Navy and Air Force, was also carried on, as was the study of personnel problems in industry under wartime conditions (cf. "Some Problems of Personnel Research", symposium in *Brit. med. Bull.* 1947, Vol. 5, No. 1). Extensive research in health problems in industry was undertaken. The publication of the *Bulletin of War Medicine* by the Council gave wide distribution of the results of its work.

Basic research into problems of radiobiology, bacteriology, and other fields was also maintained, though not, of course, on the same scale as during the pre-war years. The work of the Permanent Standards Commission of the League of Nations was

<sup>1</sup> [Cf. *The chemistry of penicillin*, edited by Hans T. Clarke, John R. Johnson & Sir Robert Robinson. Princeton: Princeton University Press; London: Geoffrey Cumberlege, Oxford University Press, 1949. This recent report on a collaborative investigation under the joint sponsorship of the Office of Scientific Research & Development, Washington, D.C., and the Medical Research Council, London, will receive a full review in the next number of the *British Medical Bulletin*.—Ed.]

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largely carried on during the war by the MRC, in the preparation and maintenance of biological standards. Large stocks of the international standards of drugs, vitamins and hormones were kept in several depots in Britain, and, under the varying exigencies of war, were despatched to Geneva, Canada and the USA for safe-keeping.

With the termination of hostilities, the Council's work has again been re-orientated, and is now proceeding along normal peace-time lines. The present report will be of considerable interest to all those who were in any way associated with wartime research, and forms a lasting record of the achievements of British medical research during the war.

D. F.

# 1360 The Rh Blood Groups and their Clinical Effects

P. L. Mollison, A. E. Mourant & R. R. Race. London: His Majesty's Stationery Office, 1948. (Medical Research Council Memorandum No. 19.) 74 pages. 24 x 15 cm. 1s. 6d. [£0.075]

- (i) The Rh groups; (ii) clinical considerations; (iii) Rh testing.

This monograph is greatly to be welcomed, as it supplies a much-needed summary of the principal facts about the Rh factor and the clinical conditions in which it is of importance. The work is divided into three parts:

- I The serological analysis of the Rh groups, the Rh antibodies and the gene frequencies in England.
- II Clinical considerations of diagnosis and treatment.
- III The indications for, and technique to be employed in, Rh tests.

Section I (by Race) provides one of the clearest expositions of the Rh antigens and antibodies yet given in English, Fisher's notation being used throughout, and the clarity is enhanced by the avoidance of any alternative system of nomenclature in the text; the equivalents in Wiener's system are, however, set out in Table V. It is thus emphasized from the beginning that Rh positive means the possession of Fisher's antigen D, and that all who display only the allele d are to be counted Rh negative irrespective of any other antigen which they may possess. There-irrespective of the other components of Fisher's linked-gene theory after the resulting 8 Rh complexes and their various introduced and the newer knowledge about the genotypes are displayed. The newer knowledge about antigenic variants of the elementary antigens is only briefly outlined, as is proper in a monograph designed to emphasize the more important rather than the more highly esoteric aspects of this work. Since this publication, further analyses of variants have been published by Race and his co-workers for those specially interested in this advanced field. Race's exposition of the genetical basis of the Rh groups is very easy to follow, though time may show it to be an over-simplification. Nevertheless it is useful in conveying a stimulating blood. Section II (by Mollison) outlines first the importance of Rh in transfusion practice and emphasizes the frequency groups in transfusion by transfusion of Rh positive blood and ease of immunization by transfusion of Rh negative blood to Rh negative recipients, a matter not yet sufficiently appreciated by many clinicians. The importance of immunization in pregnancy is next dealt with, and the seriousness of the risk of Rh positive mothers to Rh negative mothers is emphasized, as only by such practice can the risk of inadvertent administration of Rh positive blood to Rh negative mothers be minimized. Mollison also points out the clinical importance of the sub-groups of Rh and the dangers of classifying as Rh positive recipients who show the C or E antigens; such persons must also be excluded from the Rh negative donor panels in case their blood should be administered to an Rh negative recipient immunized against C or E. This matter has become even more important since the discovery that a proportion of apparently Cde (R') and Cde (R'') individuals possess a modified form of D, the so-called Du variant, the administration of which to immunize the recipient against D. This section concludes with a note on advice to the parents of affected children about future pregnancies and this will be appreciated by the harassed practitioner in dealing with anxious parents. The proportion of fathers likely to be homozygous is given as 75 per cent but this applies only to small families (two or three children); when haemolytic disease

appears only later in a larger family the proportion of heterozygous fathers rises, but of course these cases are not only less numerous but also the loss of subsequent children is less important than in the former group. The interpretation of the findings of Rh antibodies in the mother's blood during pregnancy is discussed, but the most valuable section is that on the differential diagnosis and the assessment of the severity of haemolytic disease in the newborn. Mollison's views on these matters are pretty generally accepted in Great Britain and the methods outlined might well become a standard guide to clinical practice. The directions for the transfusions of infants are extremely good and make it clear that in experienced hands are exsanguination transfusion is no more difficult or hazardous than simple transfusion; it appears, indeed, to have several advantages on the grounds of ease and simplicity. Mollison very properly directs attention to the added difficulties of trying to cannulate the internal saphenous vein by using instruments designed for operations on adults; it cannot be too strongly urged that the treatment of the newborn necessitates the provision of a set of fine instruments of suitable size which should be reserved for this purpose. Section III (by Mourant) gives precise and explicit directions for the performance of Rh tests, which will be a boon to most laboratory workers. The circumstances demanding such tests are clearly defined and all the practical points are lucidly explained. A timely plea is made for the co-operation of clinicians in securing adequate supplies of testing sera, without which the work would come to an end. The different kinds of tests used in typing the red cells are described; in the next edition of this memorandum, it would be helpful to give further directions about the detection of the weakly reacting forms of D so that they may be excluded from Rh negative group; meanwhile, in the selection of donors, any with the C or E antigens should be excluded and the use of double-agglutinin sera for this purpose is explained.

The preparation of anti-human-globulin serum (Coombs' reagent) is described and the direct and indirect Coombs' tests are fully detailed. Alternative methods of detecting Rh antibodies and the value of direct matching tests are discussed, but the impossibility of devising any single test which will satisfy all conditions is clearly pointed out. A brief note is included on the effects of cholera filtrate and of trypsin on the agglutination of red cells but these special methods are not advised for routine use. The methods of absorbing unwanted agglutinins from test-sera are briefly stated, but the use of purified A and B substance is omitted, absorption with red cells of appropriate groups or with saliva being recommended. In view of Morgan's work this omission is surprising, and might well be remedied in any future edition.

As a whole this monograph is a fine production and is timely; as a summary of the very real contributions to knowledge in this sphere made by British workers. If it has avoided controversial matters of nomenclature by ignoring them, the presentation of facts is thereby clarified, and it will undoubtedly greatly facilitate the dissemination of knowledge on this highly complex and somewhat esoteric subject.

D. F. Coppel

# 1361 Symposia of the Society for Experimental Biology. Number I. Nucleic Acid Biology.

Society for Experimental Biology. Cambridge: Cambridge University Press, 1947. vi + 290 pages; 29 figures; 18 plates. 25 x 16 cm. £1 15s. [£1.75]

- (i) The structures of nucleic acids; (ii) structure and synthesis of nucleotides; (iii) the biological synthesis of purine compounds; (iv) the macromolecular behaviour of nucleic acids; (v) X-ray studies of nucleic acids; (vi) the distribution of nucleic acids in tissues; (vii) bacterial nucleic acids and nucleoproteins; (viii) a study of techniques for the cytochemical demonstration of nucleic acids and some components of proteins; (ix) ribonucleic acid and the vital staining of cytoplasmic vacuoles in animal cells; (x) the relations between nucleic acid and protein synthesis; (xi) protein and nucleotide metabolism in the nerve cell under different functional conditions; (xii) nucleic acid in nerve-cell regeneration; (xiii) tissue changes in mice treated with pentose nucleotides; (xiv) histochemical observations on nucleic acids in homologous normal and neoplastic tissues; (xv) nucleic acids in the cell and the embryo; (xvi) the action of enzymes on chromosomes; (xvii) the function of deoxyribose-nucleic acid in the cell nucleus; (xviii) nucleic acid and the chromosomes; (xix) the experimental modification of nucleic acid systems in the cell.

The Society for Experimental Biology of Great Britain has adopted the custom of holding meetings from time to time in a university centre, where several days are devoted to the discussion

of some suitable subject of general biological interest. Such a symposium was held in Cambridge in July 1946 when the subject for discussion was "Nucleic acid", and the papers given at this meeting were published in the form of Number I of the *Symposia of the Society for Experimental Biology*. They are the products of some twenty different authorities on the subject, of several nationalities, and they cover a very wide range. The purely chemical aspects of the nucleic acids are discussed by Gulland, by Jordan, by Lythgoe & Todd, and by Astbury, while the more biochemical aspects are dealt with by Kalckar, by Davidson and by Stacey. Cytochemical contributions are made by Danielli and by Dustin. An important paper by Caspersson summarizes the work of the Stockholm school on the relation of nucleic acid to protein synthesis. The nucleic acids of nervous tissue are discussed by Hyden and by Bodian, of tumours by Stowell and of embryonic tissues by Brachet, while Parsons, Gulland & Barker describe the effects of pentose nucleotides on living tissues. Problems of the cell nucleus, chromosomes and genetics are discussed by Catcheside & Holmes, by the Stedmans, by Darlington and by Koller.

This book, therefore, contains information on nucleic acids which will be of interest to a large number of readers whose own spheres of work may vary from synthetic organic chemistry to pure cytology. But the chemist may well profit by reading of the biological implications of the nucleic acids, just as the biologist may derive benefit from information about the more chemical aspects.

The nucleic acids have aroused so much interest of recent years that a publication of this sort in which information covering a very wide range is collected together must inevitably be of great value. The Society of Experimental Biology is to be congratulated, not only on organizing the symposium and arranging for authorities in the nucleic acid field from different parts of the world to meet together, but also for initiating a new series of review publications on topics of wide biological interest.

The scientific reader at the present day is faced with the problem of keeping up to date not merely with original papers but with a rapidly increasing number of reviews and annuals in which original papers are summarized. But where a review is in fact a report of the deliberation of a group of experts who meet together to discuss their common interest from different angles, its publication is both justified and to be commended.

J. N. Davidson

## NEUROLOGY

### 1362 Critical Studies in Neurology

F. M. R. Walshe. Edinburgh: E. & S. Livingstone Ltd., 1948. xv + 256 pages. 22 x 14 cm. 15s. [£0.75]

(i) The anatomy and physiology of cutaneous sensibility; (ii) the giant cells of Betz, the motor cortex and the pyramidal tract; (iii) on the mode of representation of movements in the motor cortex, with special reference to "convulsions beginning unilaterally" (Jackson); (iv) on the notion of the "discrete movement" in willed motion; (v) on the rôle of the pyramidal system in willed movements; (vi) the integration of medicine.

For many years Dr. Walshe has had a wide public, for the obvious reason that he not only strikes a fresh note, but is always critical in a stimulating way. He does fine work both in his lectures and in his writings in enlarging our understanding of some of the problems which he is turning over in his mind. At one time his thought seems to pierce the proposition like lightning; at another he is able to exercise the patience of Job in awaiting a true interpretation of his facts. This pattern, or type of approach, is found in only a few of our pioneers, perhaps notably those with the soundest psychological training; the facts are one thing, available to all accurate workers, but the correct interpretation requires much critical thought, a relatively simple matter for some, but quite beyond the capacity of many. As Dr. Walshe says in his foreword:

There should be a wide measure of agreement upon the crying need for critical thought in neurology. By no other intellectual weapon can we hope to deal effectively with what Trotter has called 'the mysterious variability of the false'; a variability that we owe in part to the uncritical spirit in which some write and others read original papers . . .

The papers which comprise this book have all been published during or after 1942, five of them in *Brain*. First is the essay on the anatomy and physiology of cutaneous sensation. This

is a lengthy review of a fascinating subject where some famous giants of the past, Head, Rivers, Trotter, and more recently, Sherrington, form stepping-stones over which the author proceeds with care and respect, yet not without criticism. Next comes his study of the giant cells of Betz, the motor cortex, and the pyramidal tract. Here he describes carefully the earlier researches to determine the origin of the pyramidal tract, showing that even the remarkable progress in forty years still leaves many questions unsettled, and emphasizing again the limitation of the cellular approach when it is considered alone. Then follows "On the Mode of Representation of Movements in the Motor Cortex, with Special Reference to 'Convulsions Beginning Unilaterally' (Jackson)", a shorter essay which debates the experimental and the clinical evidence concerning localization. The two relatively brief chapters which follow are both on the theme of "willed motion", the second one being an elaboration of Walshe's paper at the Neurological Section of the International Conference of Physicians in London, September 1947. In this the author offers valid arguments showing the defects he sees in the now widely held conception of pyramidal function.

The last paper is entitled "The Integration of Medicine" and is reprinted from the *British Medical Journal* (1945), 1, 723. It is the thoughtful and challenging oration given to the Medical Society of London in May 1945. Perhaps this chapter might have preceded the others, not only because it seems to indicate so clearly the author's approach and philosophy, but also because it brings the reader into step at a moderate pace, and sharpens his critical faculties to enable him to enjoy the great wealth of material contained in the more definitive chapters. Now gathered together in this easily accessible volume, these papers will be widely read or re-read. Let us hope that Dr. Walshe is contemplating further exercises for our benefit.

J. K. S.

### 1363 Headache and Other Head Pain

Harold G. Wolff. New York: Oxford University Press; London: Geoffrey Cumberlege, 1948. xxii + 642 pages; 154 figures. 24 x 16 cm. £3 3s. [£3.15]

(i) Pain-sensitive structures within the cranial cavity; (ii) headache associated with changes in intracranial pressure; (iii) headache and brain tumor; (iv) headache from distention of cerebral and pial arteries; (v) the cerebral circulation and the headache of subarachnoid hemorrhage; (vi) the extracranial blood vessels as pain-sensitive structures; (vii) inflammation of cranial arteries as a source of headache and other pain; (viii) headache in the migraine syndrome; (ix) the relation of life situations, personality features, and reactions to the migraine syndrome; (x) modification of intensity and frequency of headache in the migraine syndrome; (xi) vascular accidents with migraine headache; (xii) headache associated with arterial hypertension; (xiii) 'cephalgias' and 'atypical neuralgias' of the face and head; (xiv) the teeth as sources of headache and other pain; (xv) the nasal, paranasal, and aural structures as sources of headache and other pain; (xvi) the eyes as a source of headache and other pain; (xvii) muscles of the head and neck as sources of headache and other pain; (xviii) chronic post-traumatic headache; (xix) typical or major neuralgias ('tic douloureux'), postinfectious neuralgias, neuritis, and 'intractable pain'; (xx) the action of analgesics; (xxi) summary. Clinical differentiation. Addendum. Index.

This publication consists of a very full account of the research that has been carried out by Wolff and his co-workers, during the past fifteen years, into the mechanism of the various types of headache. Those who keep abreast with advances in medicine will have read many of the author's papers on the subject as and when they have appeared in various American medical journals, and will already be reaping the benefit of the vast amount of new knowledge which Wolff's work has brought to the understanding of a common and important symptom.

Nevertheless, to have the whole of this work in one volume is a most valuable addition to medical literature and the book will not only be much used for reference but will also be regarded as a model of well-planned and logical clinical research. It is too long to hold any great appeal to the undergraduate and to him the author's contribution to the *Text-book of medicine* by Cecil & Kennedy, which contains all the essential information in abbreviated form, is especially recommended, but there is no doubt that it is a book which every neurologist, general physician and medical library should have.

As with most American publications, the paper and printing are beyond reproach and the reproduction of the diagrams is excellent. In addition the author's style is most readable and lucid and his practice of including a brief summary at the end of each chapter has much to commend it. That he has included in his investigations the headaches of hypertensive, otological,



rhinological, ophthalmic and dental origin shows that the author is in no sense of the word a "pure" neurologist, and greatly adds to the value and comprehensiveness of the work.

The only serious criticism that can be made is that too little reference is made to headache of psychogenic origin. There can be no doubt that this is the commonest form of headache for which medical aid is sought and though many such cases arise from prolonged spasm of the muscles of the scalp and neck, which mechanism the author has investigated very fully and described very clearly, there remains a large number that cannot be so explained. It is probable, however, that the elucidation of such cases lies more within the ambit of the psychiatrist than of the neurologist.

The author makes a valiant attempt to introduce some order into the chaos of nomenclature, thought and therapy that surrounds the various forms of atypical facial and migrainous neuralgia. However, in view of the fact that such conditions are by nature almost entirely subjective in their manifestations, it appears likely that the future will bring the descriptive separation of more and more "new" types, with appropriate speculation as to their mechanism and advice regarding their cure.

A. G. W. Whitfield

## NURSING

### 1364 Report of the Working Party on the Recruitment and Training of Nurses

Ministry of Health, Department of Health for Scotland & Ministry of Labour and National Service. London: His Majesty's Stationery Office, 1947. v + 122 pages. 24 x 15 cm. 2s. 6d. [£0.125]

(i) Method of approach; (ii) number of nurses; (iii) structure of the nursing profession; (iv) intelligence of nurses; (v) estimated intake and loss of trained nurses; (vi) estimated intake and wastage of student nurses; (vii) wastage during training; (viii) the training of nurses—the present position; (ix) the training of nurses—a new system; (x) some implications of the new scheme of training; (xi) selection of student nurses; (xii) organisation and administration; (xiii) effects on staffing of converting to a three-shift system and student status; (xiv) the assistant nurse; (xv) summary of main conclusions. Note by the Chairman. Note by Dr. J. Cohen. Appendices: (i) references; (ii) percentile norms for the progressive matrices test; (iii) statistics relating to intake and wastage of student nurses in Great Britain; (iv) selection for senior posts in hospitals; (v) number of nurse training schools; (vi) length of present training courses; (vii) nursing techniques; (viii) "post-graduate" education; (ix) supervision of nurses' health; (x) nursing the chronic sick; (xi) mental nursing.

### Working Party on the Recruitment and Training of Nurses. Minority Report

Ministry of Health, Department of Health for Scotland & Ministry of Labour and National Service. London: His Majesty's Stationery Office, 1948. vi + 78 pages. 24 x 15 cm. 1s. 6d. [£0.075]

(i) The problem of estimating the nursing needs of the community; (ii) the inadequacy of opinion as a basis for policy in the nursing field; (iii) the value of research as a basis for planning the nursing services; (iv) the measurement of the effectiveness of nursing care; (v) the productivity of nurses; (vi) conclusions, recommendations and acknowledgements. Appendices: (i) references; (ii) relationship between duration of stay of patients in hospital and nurse staffing ratios; (iii) extracts from statements or letters sent by a sample of ex-student nurses; (iv) number of chronic sick and aged infirm in public assistance institutions and municipal hospitals in England and Wales at 31st August, 1946; (v) number of occupied beds and full-time nurses and midwives (male and female) employed in civilian hospitals in Great Britain at mid-1947; (vi) growth of the nursing and midwifery professions in England and Wales.

These Reports summarize the findings of a Working Party appointed in January 1946 to review the position of the nursing profession. The Report represents the views of Sir Robert Wood (the Chairman), Miss D. C. Bridges, Miss E. Cockayne, and Dr. T. D. Inch. One member of the Working Party, Dr. J. Cohen, found himself unable to concur, and has presented a Minority Report.

The Working Party enquired into the length and type of training desirable to equip nurses to fulfil their tasks, the annual intake of students required, the means of selecting these and the measures needed to reduce wastage in training. The available literature and previous reports on these subjects were carefully studied; extensive field studies in over 200 hospitals were carried out; and representative nurses of all grades employed in every branch of

the profession were interviewed. A "job analysis" of the work done by nurses in training was undertaken.

The Working Party found that the wastage during training was a key point in the enquiry: excluding failures at the final examinations and excluding nurses employed in mental hospitals, this was estimated at 36%. Some of this was found to be due to unsuitable temperament and therefore reflects faulty selection of students, but impartial investigation showed that discontent and frustration were cogent factors. It was found that discipline was often too harsh and unreasonable, and that the amenities of life of those in training and their hours of work all required reform. In interviews with student nurses by the Working Party, complaints were said to be "not the vague complaints of a discontented minority but the conclusions of a statistical survey."

Based on job analysis studies, the Working Party concluded that a two-year course of training for all nurses would be adequate, with provisional registration at the end of two years, followed by a further year of supervised practice before licence to practise was given. In effect, this is a training for three years, with the last year free from academic study. Eighteen months to two years would cover training in all branches of nursing, the final six months of the two years to be taken in one special branch. This would give a uniform title (State Registered Nurse) and qualification for all nurses. The period of training for student nurses would be based on a five-day week of 40 hours, with six weeks' annual leave. There was a strong recommendation that the finance of nurse training should be independent of hospital finance. All student nurses should continue to receive free tuition with board residence or an allowance in lieu and a suitable allowance for personal expenses.

It was also advised that a three-shift system of work in hospitals should be instituted. To give effect to this, and to allow the student nurses to take full student status, would require an estimated increase of 22,000 to 24,000 trained nurses and some 14,000 nursing orderlies. It was thought that to provide for existing needs and training reforms a force of not less than 120,000 and possibly 125,000 trained nurses would be needed. It was considered impossible to determine the number of additional staff required for the expansion of the National Health Service.

Dr. Cohen found it impossible to sign the Report, since in his view its recommendations failed to take sufficient account either of the relation between the planning of nursing and the other health services and the planning of the nation's labour resources as a whole, or of the extent to which methods employed in psychological research can provide a scientific basis for determining nursing and medical staffing ratios or determining the length of training periods for nurses. He feels that we have yet to discover the optimum number of beds per thousand population and the optimum number of nurses required to look after them; these things should be not matters of opinion but matters of fact ascertainable by scientific investigation.

He argues that "the task of nurses and doctors alike . . . is, presumably, to speed the patient's recovery", and takes as the economic criterion of nursing effectiveness the duration of the patient's stay in hospital. In an investigation of 260 voluntary<sup>1</sup> hospitals he found that, on the whole, this was shorter in well-staffed hospitals. This evidence supplies him with a *prima facie* case for increasing the number of nurses in general hospitals. Few people, however, will agree with the basic assumption on which all this is founded—namely, that the duration of the patient's stay in hospital is a satisfactory objective measure of the task of nurses and doctors. In fact, the length of stay is affected by many factors other than the ratio of staff to patients. Apart from the type of illness, it varies with the custom of the hospital, its facilities for investigation, treatment and after-care, with the whims of doctors and the pressure of the waiting list, to say nothing of the individual patient's reactions to hospital environment and medical treatment.

In summary, the Working Party's Report is a welcome document. The "job analysis" represents a new way of discovering facts by objective investigation. Its main shortcomings are its failure to secure the necessary data to answer the question, "What

<sup>1</sup> 'Voluntary' used in this sense "means not carried on for profit and not provided by a local or public authority" (*The National Health Service Act, 1946, annotated* . . . S. R. Speller, p. 126, London, 1948). Since the inauguration of the National Health Service, voluntary hospitals have been incorporated in the State medical service.—[Ed.]



is the proper task of a nurse?", and its failure to indicate from where the desirable candidates for training as nurses are to come. Nevertheless, the Report has stated the problem and it is up to the Ministries concerned, the present nursing profession and those who are to be nursed, to find out the proper answers.

The well-being of the country depends on the proper answers being found.

## OPHTHALMOLOGY

### 1365 *Lehrbuch der Augenheilkunde*

Edited by M. Amsler, A. Brückner, A. Franceschetti, H. Goldmann & E. B. Streiff. Basel: S. Karger, 1948. xx + 858 pages; 342 illustrations; 4 tables. 25 x 17 cm. 85 Sw. fr.

I. Allgemeiner Teil. (i) Untersuchungsmethoden; (ii) allgemeine Symptomatologie; (iii) Auge und Gesamtorganismus; (iv) Vererbung und Auge; (v) soziale Fragen in der Augenheilkunde; (vi) allgemeine Therapie. II. Spezieller Teil. (vii) Anatomie; (viii) Physiologie des Auges; (ix) das Glaukom; (x) Verletzungen; (xi) Krankheiten der Bindehaut; (xii) Krankheiten der Hornhaut; (xiii) Krankheiten der Lederhaut; (xiv) Krankheiten der Uvea; (xv) die Pupille; (xvi) Krankheiten der Linse; (xvii) Krankheiten des Glaskörpers; (xviii) Krankheiten der Netzhaut; (xix) Krankheiten des Sehnervens; (xx) Krankheiten der Sehbahn; (xxi) Krankheiten der Augenlider; (xxii) Krankheiten der Tränenorgane; (xxiii) Mollitätsstörungen des Auges; (xxiv) Krankheiten der Orbita. III. Augensymptome bei Allgemeinerkrankungen. (xxv) Augensymptome bei inneren Erkrankungen im weiteren Sinne; (xxvi) Augensymptome bei Frauenkrankheiten; (xxvii) Augensymptome bei chirurgischen Erkrankungen; (xxviii) Augensymptome bei Zahnkrankheiten; (xxix) Augensymptome bei Geisteskrankheiten; (xxx) Augensymptome bei Tropenkrankheiten; (xxxi) Augensymptome bei Hautkrankheiten; (xxxii) Augensymptome bei Hautkrankheiten; (xxxiii) Augensymptome bei Hals-, Nasen- und Ohrenkrankheiten. Sachregister.

This textbook of ophthalmology is intended for the student and for the general practitioner. In format and size it resembles the well-known textbooks of Axenfeld and of Fuchs, which have not been readily available for some time. Ophthalmology in Switzerland is very much alive and in this book Swiss ophthalmologists, and also Professor Weve of Utrecht, give a sound presentation of Continental teaching. Like every new book it has the advantage of being free from dead wood, which is so difficult to cut out from revised editions of older textbooks. More space is given to the basic sciences than usual; thus, out of some 800 pages, anatomy and embryology occupy nearly 90 pages, genetics and physiology some 50 pages each, and pharmacology and physical medicine some 40 pages. The chapter on genetics appears to be too detailed for the clinician, both in its theoretical and in its clinical aspects, but the importance of genetics is certainly brought home, even if such fine distinctions as the differential diagnosis of retinitis punctata albescens from fundus albino-punctatus cum hemeralopia are beyond the scope of those for whom the book is intended.

Clinical ophthalmology is lucidly presented and the results of modern methods of investigation are included. In the chapter on glaucoma the importance of the disease is emphasized by statistics showing its incidence, its relation to sex and the influence of weather in the occurrence of acute attacks. Though gonioscopy is not mentioned by name, descriptions and illustrations of the angle are given. Enlargement of the blind spot is given as the first change in the field; this differs from Traquair's teaching. In the chapter on muscles, diagnosis is mostly based on the double-image test with the red-green glass, and apparently major amblyoscopes and the prism-and-cover test are not popular. A printing error in the diagnostic table of muscle palsies needs correction. In the chapter on chemical burns, Denig's operation is advocated and a useful test for the vitality of the damaged conjunctiva is described; amniotic membrane grafting is not mentioned. The chapter on eye and general diseases, together with that on genetics and the many references to general medicine dispersed throughout the book, emphasize an aspect of ophthalmic teaching not well covered by the older texts.

The careful presentation both of text and illustrations makes the book stimulating reading; it is more than the foreword claims for it.

M. Klein

### 1366 *The Practice of Orthoptics*

G. H. Giles. London: Hammond, Hammond & Co. Ltd., 1947. 366 pages; 67 figures. 22 x 14 cm. £1 10s. [£1.5]

Part I. Introduction to the practice of orthoptics. (i) The basis of orthoptic treatment; (ii) routine refractive examination; (iii) the refractive error in squint and heterophoria; (iv) the recognition of unfavourable cases of strabismus; (v) the recognition of favourable cases of strabismus—routine examination (1); (vi) the routine examination (2); (vii) the selection of orthoptic cases of strabismus; (viii) heterophoria—detection and measurement; (ix) the selection of heterophoria cases suitable for orthoptic training; (x) the measurement of the fusional reserves; (xi) the mental effort; (xii) the psychological approach to squint treatment. Part II. The clinical practice of orthoptics. (xiii) The treatment of concomitant strabismus in outline; (xiv) the treatment of concomitant strabismus in detail; (xv) amblyopia, occlusion, and abnormal retinal correspondence; (xvi) the treatment of strabismus in young children; (xvii) the treatment of special types of strabismus; (xviii) the orthoptic treatment of horizontal heterophoria; (xix) the orthoptic treatment of hyperphoria, cyclophoria, and convergence insufficiency; (xx) the use of prisms and lenses in orthoptic practice; (xxi) the orthoptic treatment of service candidates; (xxii) naturopathic methods: a comparison with orthoptics. (xxiii) Glossary. Appendix I. Statistical survey of 116 orthoptic cases. Appendix II. Table of stages in treatment of strabismus. Appendix III. Diagnostic table—paralysis of the motor muscles. Bibliography. Index.

Although the author gives a great deal of useful practical information in this book, he suffers from not having had the opportunity of working in an orthoptic clinic of a hospital where in-patient surgical treatment is available, and where the full medical aspect of the case can be assessed. In consequence he neglects to evaluate the help obtainable from surgical treatment in cases of strabismus. This is exemplified by the statement made on page 195 with regard to the treatment of concomitant convergent strabismus in children, which reads: "... where the squint is alternating, and vision equal in both eyes, the squint can be safely left providing due care and attention are paid to the refractive error. The patient reports periodically for observation, but as a rule no orthoptic training is given until the child can appreciate what is meant by mental effort." Meanwhile the child labours under the adverse psychological effect of his physical deformity, and all the time is consolidating the secondary sensory and motor correspondences, which later will be difficult, or perhaps impossible, to eradicate. In the case of squint, as in any other physical deformity, an attempt should surely be made to cure the condition forthwith, not only cosmetically but also functionally. There is no doubt, therefore, that early operation is indicated in a large number of cases.

The chapter entitled "The Selection of Orthoptic Cases of Strabismus", which incidentally would be better entitled "The Selection of Cases of Strabismus for Orthoptic Treatment", is good, and clearly set out. The section of the book describing treatment is in the main good, and it is refreshing to find that Mr. Giles does not suffer, as so many orthoptists do, from being too synoptophore-minded, but appreciates the value of simpler forms of apparatus.

While realizing that ocular palsies are outside the scope of the book, the author has included two misleading diagrams (fig. 16, 21) which are intended to show the actions of the extrinsic ocular muscles. One would have thought that by now it was universally recognized that although the vertically acting recti muscles are adductors, they produce their maximum vertical action when the eye is in the abducted position. Similarly, although the obliques are abductors, they can produce their maximum vertical action only when the eye is adducted. It is the old story of one author copying another author's diagram without due consideration as to its veracity.

The statement on page 68 to the effect that "... it is rare" (in cases of ocular palsy) "to find only one muscle affected ..." probably indicates a lack of appreciation of the sequelae that take place following palsy of a single extrinsic ocular muscle, i.e., overaction of the contra-lateral synergist, contracture of the direct antagonist, and secondary inhibitional palsy of the contra-lateral antagonist.

The value of mental effort in the treatment of strabismus is undisputed, but one would have preferred to see photographs (fig. 35) that purport to show the effect of mental effort in a case of convergent strabismus explained on a physiological rather than a psychological basis, i.e., that when the eyes are elevated and accommodation relaxed the visual axes tend to diverge.

Fig. 36 is misleading. In the left-hand photograph the patient is clearly looking to the left, whereas in the right-hand photograph he is looking into the distance. One doubts if there is actually any difference in the angle of deviation shown in the two pictures!

The best part of the book is the practical advice given with regard to the use of the various instruments in orthoptic work. The author is to be congratulated on his handling of the subject, and also on the excellent bibliography. He has obviously taken an immense amount of trouble in the preparation of this book and has included interesting information on orthoptic treatment of candidates for flying duties, and on naturopathic methods of treatment. This is certainly a book that should be read by anyone who practises or who is interested in orthoptics.

T. Keith Lyle

## 1367 Modern Trends in Ophthalmology. Volume II

Edited by Arnold Sorsby. London: Butterworth & Co. Ltd., 1948. xix + 600 pages; 169 figures; 3 plates. 25 x 17 cm. £3 3s. [£1.15]

Section I. Physiology. (i) The nature of light; (ii) illumination; (iii) night vision; (iv) the electrophysiology of the retina; (v) antagonism and interaction in vision; (vi) senescence of the eye; (vii) mucopolysaccharides and mucoids of ocular tissues and their enzymatic hydrolysis; (viii) some subjective aspects of accommodation; (ix) variations and correlations of the optical components of the eye; (x) X-ray measurement of the diameters of the living eye. Section II. Diagnostic procedures. (xi) Contributions of the slit-lamp (biomicroscope) in the elucidations of clinical entities; (xii) gonioscopy; (xiii) angioscotometry; (xiv) ophthalmodynamometry and some of its clinical applications. Section III. Pathology. (xv) The nature of sporadic congenital malformations; (xvi) some genetic aspects; (xvii) ocular manifestations of vitamin deficiencies; (xviii) clinical lesions due to radiant energy; (xix) focal infection (1); (xx) focal infection (2); (xxi) virus affections of the eye; (xxii) some newly defined clinical entities affecting the conjunctiva; (xxiii) affections of the retinal veins; (xxiv) retinal and choroidal tumours; (xxv) abnormal pupillary reactions; (xxvi) lesions of the retina and optic nerve in association with blood dyscrasias; (xxvii) hereditary optic atrophy as a manifestation of the heredo-ataxias; (xxviii) detachment of the retina; (xxix) the pathogenesis of visual disturbances in glaucoma; (xxx) hypertensive retinopathy. Section IV. Treatment. (xxxi) X-ray and Grenz-ray treatment in ophthalmology; (xxxii) radiotherapy in ophthalmology; (xxxiii) sulphonamide therapy; (xxxiv) penicillin; (xxxv) the scope of retrobulbar alcohol injection; (xxxvi) orthoptics; (xxxvii) contact lenses; (xxxviii) ophthalmic ointments; (xxxix) trends in cataract surgery; (xl) the surgery of non-magnetizable intra-ocular foreign bodies; (xli) the blocked naso-lacrimal duct; (xlii) lessons from modern warfare (1); (xliiii) lessons from modern warfare (2); (xliv) amniotic membrane grafts in burns. Section V. Social aspects. (xlv) Some problems of industrial ophthalmology; (xlvi) the ocular manifestations of leptospirosis; (xlvii) some ocular aspects of aviation; (xlviii) the care of the blind in England and Wales. Index.

The purpose of the volumes in this series is to provide for the clinician who wishes to keep abreast of the most recent developments in his specialty a conspectus of that field of knowledge intermediate between the systematized information of the textbook and the latest scientific research reported disjointedly and only too copiously in current periodical literature. It is their aim to indicate "emergent tendencies and formative influences."

To this end 48 chapters have been contributed by 44 authors, drawn from most of the countries of Europe and America. Their wide range of subjects can be seen from the list of contents given at the head of this review. The volume ends with four chapters on social aspects, one of which discusses some problems of industrial ophthalmology, while another deals with the care of the blind in England and Wales.

It would be invidious, not to say presumptuous, to attempt to assess the comparative worth of individual contributions. All are interesting and, since they contain new knowledge, valuable. Time will, as always, show that some of the trends are towards blind alleys, and some of the new knowledge it will assess as worthy only of a brief note in the dustiest of archives. It is, however, works of this type which help the clinician to keep in advance, as he should, of the teaching of the textbook, and it is to be hoped that the two volumes already published will be followed by others at regular, and not too long, intervals.

The book is well produced and seems to have been most ably and impartially edited; not only have the professed aims of exclusion of the well-established and inclusion of new points of view been consistently achieved, but the various chapters are all equally, and eminently, readable. There is a good index and most of the chapters carry short but adequate bibliographies as the starting points of more extensive reading in any particular subject. The book is most useful in giving a short outline of recent progress and in indicating some of the lines along which further developments in ophthalmology will take place.

A. J. B. Goldsmith

## 1368 Clinical Ophthalmology for General Practitioners and Students

H. M. Traquair. London: Henry Kimpton, 1948. xii + 264 pages; 64 figures; 8 plates. 22 x 14 cm. £1 5s. [£1.25]

(i) Anatomy; (ii) physiology, including physiological optics; (iii) diagnosis; (iv) examination of the eye; (v) abnormalities in the pupils; (vi) causation of eye affections; (vii) therapeutics; (viii) refractive errors and their symptoms; (ix) squint, concomitant; (x) squint, paralytic; (xi) eyelids; (xii) lacrimal apparatus; (xiii) orbit; (xiv) the conjunctiva and the red eye; (xv) cornea; (xvi) sclera; (xvii) iris and ciliary body; (xviii) glaucoma; (xix) lens; (xx) visual path and field of vision; (xxi) impairment of sight without obvious external signs; (xxii) eye changes in some diseases of the nervous system; (xxiii) eye changes in some systemic diseases; (xxiv) functional ocular manifestations; (xxv) the eye in infancy and childhood; (xxvi) the eye in old age; (xxvii) misconceptions and prejudices. Appendix. Medico-legal reports. Formulary. Index.

This book has been written for the undergraduate and the general practitioner but it deserves the attention of a wider public.

Its language is simple and its teaching essentially practical. The eye conditions commonly met in everyday practice are dealt with concisely, but with relatively full notes on treatment which can be done without specialist knowledge and equipment. In this connexion one would say that more is expected of the general practitioner north than south of the Border.

There are excellent chapters on the routine examination of the eye, the meaning and significance of refractive errors and squints, therapeutic measures, visual fields, functional ocular manifestations and on misconceptions and prejudices. The chapter on impairment of sight without external signs, and some other parts of the book, are hampered by the intentional avoidance of the use of the ophthalmoscope, although one might say that the author has unintentionally shown such an avoidance to be an impossibility. There is little else to criticize, but one would contend that an acutely glaucomatous eye is not necessarily a red eye.

The book is most readable and its chief virtues are its wisdom and common sense. These alone should commend it to all who practise ophthalmology.

A. Lister

## PSYCHOLOGICAL MEDICINE

### 1369 Clinical Psychology. A Case Book of the Neuroses and their Treatment

Charles Berg. London: George Allen & Unwin Ltd., 1948. vi + 503 pages. 22 x 14 cm. £1 5s. [£1.25]

Section I. From medicine to mind. Section II. The problem of anxiety. Section III. The hysterics. Section IV. Some more severe illnesses. Section V. Treatment. Glossary. Index.

Dr. Berg is a provocative but extremely readable and lucid writer. Even the title of his book arouses criticism, as it does not fulfil the reader's hopes of learning something of the contribution made by the various schools of psychology towards our understanding of clinical problems; they are summarily dismissed as "academic", and clinical psychology is equated with psychoanalysis and its derivatives. The book's sub-title, "A case book of the neuroses and their treatment", would appear to be more representative of its contents; the writer develops his ideas on etiology, psychopathology, and treatment by means of varied and vivid accounts of his patients and their disorders. By his manner of presentation even more than by what he actually says, Dr. Berg pours scorn not only on physical forms of psychiatric treatment, but also on superficial methods of therapy ranging from simple advice and social management to unorthodox analytical approach and group therapy. And yet, later on, he acknowledges the improvements produced by these immediately practicable therapeutic approaches and the limited applicability of the one and only method, psychoanalysis, thought capable of producing a genuine cure of the basic disorder. At the same time, he condemns orthodox Freudianism, and sides with those analysts who believe that on the basis of the principal foundations laid by Freud a variety of structures may develop.

Dr. Berg's illustrative records of the histories and more important phases of treatment are particularly convincing, because only rarely is the patient 'cured' and the limitations of any form of treatment in psychiatry are shown up clearly; he states that psychotherapy can produce a limited, but in some cases very useful amelioration of the patient's symptoms by bringing into

consciousness emotionally significant contents of his childhood and infancy; beyond this, and far more important than environmental traumata, lies the patient's constitution as inherited at conception, and thus outside the reach of psychotherapy.

The first part of the book contains a description and discussion of various functional disorders from the dynamic point of view. Anxiety, or more fundamentally sexual tension, is looked upon as the prime mover in producing nervous or mental breakdown. Normally, these tensions obtain adequate discharge along instinctual or sublimated paths; but should they not gain this outlet, a morbid condition arises, finally leading to a violent bursting forth in the form of psychiatric symptoms. The resulting clinical picture is thought to depend on the physical and psychical structure of the individual. Following Reich, the author draws a parallel between nervous breakdown and sexual orgasm, and compulsive overwork is looked upon as the tumescent phase of a process of which nervous breakdown is its detumescence. For the causation of the more serious illnesses, including schizophrenia, etiological theories are put forward along familiar psychoanalytic lines, with the addition that Berg is a neo-Lamarckian and favours the view that morbid reaction tendencies as acquired by successive generations are transmitted, and can finally produce overt psychotics. In the second part of his book Dr. Berg discusses the various types of psychiatric treatment, giving a particularly clear account of the theory and practice of psychoanalysis.

Dr. Berg's book should be of great interest to general practitioners as well as psychiatrists who wish to acquaint themselves with the views on the theory and practice of psychological medicine arrived at by a widely experienced, psychoanalytically orientated, psychiatrist.

Felix Past

### 1370 *The Psychology of Behavior Disorders: a Biosocial Interpretation*

Norman Cameron. Cambridge, Mass.: Houghton Mifflin Company, 1947. xxi + 622 pages; 2 figures. 22 x 15 cm. £1 5s. [£1.25]

(i) Introduction; (ii) personality development and behavior disorders; (iii) behavior organization and behavior pathology; (iv) language, thought and role-taking in behavior disorders; (v) need, frustration, and conflict; (vi) basic adjustive techniques; (vii) hypochondriacal disorders; (viii) fatigue syndromes; (ix) anxiety disorders; (x) compulsive disorders; (xi) hysterical disorders; (xii) hysterical disorders: autonomy; (xiii) delusions and hallucinations in behavior disorders; (xiv) paranoid disorders; (xv) schizophrenic disorders; (xvi) manic and depressive disorders; (xvii) behavior disorders and cerebral incompetence; (xviii) therapy as biosocial behavior. Index.

This book is an attempt to produce an essentially social interpretation of all disorders of behaviour. Today man is regarded as a psycho-socio-biological unit, and understanding of human behaviour necessitates an approach from all these three aspects. Just as any attempt to explain man's behaviour purely in terms of anatomy and physiology has so far failed and is likely to continue to fail, so will attempts to explain it entirely in social terms.

On the other hand, *The psychology of behavior disorders* contains much that is refreshing and illuminating. It applies normal academic psychology and attempts to show that abnormal behaviour is merely an exaggeration of certain aspects of the normal. Although frequently impressed by the verbal arguments put forward, one was nearly always left with a feeling of "why?" Much of the work is descriptive rather than dynamic-interpretative. Wide use is made of the concept of functional autonomy of motive. This may supply a superficial explanation of behaviour, but frequently one is left to wonder why such behaviour ever arose; and even if an adequate explanation of this point is given, there is none as to why it then became autonomous.

No real notice is taken in the book of constitutional differences, and the biological side is regarded as a fixed element which can therefore be ignored. Individual differences of reaction to the same social stresses are inadequately explained.

Psychoanalytic theory is no less ignored than the biological aspect of man. The concept of the unconscious is rejected as an unnecessary hypothesis. We are returned, at least in part, to "behaviourism". Many psychoanalytic concepts, however, are used. This applies particularly to the chapter, "Basic Adjustive Techniques." Terms like "repression" and "regression" have by now a fairly well-established meaning in psychopathology

owing to their use and elaboration by the psychoanalysts. They are defined in this book in the accepted way, but the dynamics of these defence measures as previously elaborated by others are rejected. The new explanations given here do not appear to be an improvement, even if one disagrees with earlier explanations.

The description of the various behaviour disorders is reasonably accurate, although there are many points here and there on which psychiatrists will tend to disagree with the author. The definition given of "agitated depression" states that it occurs "... without serious behavior disorganization..." This is a dogmatic statement which many would see fit to challenge.

As a whole the book is not without interest; the earlier chapters are perhaps the best. Theory has to be stretched at times, when it is applied to the psychoses. Social theory will give, as would be expected, a partial, but never a whole, explanation of behaviour.

In spite of its verbosity, this book can be recommended, if only as the expression of an extremist's point of view.

R. Orton

### 1371 *Clinical Studies in Psychopathology. A Contribution to the Aetiology of Neurotic Illness*

Henry V. Dicks. Second edition. London: Edward Arnold & Co., 1947. 238 pages. 22 x 14 cm. 15s. [£0.75]

(i) Introduction; (ii) anxiety states; (iii) special forms of anxiety symptoms: phobias; (iv) obsessional states; (v) hysteria; (vi) the play of opposites; (vii) some perversions of sexual aim; (viii) abnormalities in sexual function; (ix) drug additions; (x) some general considerations and conclusion. Index.

This book originated from a series of lectures given to doctors and other students of psychopathology at the Tavistock Clinic, and presupposes in the reader comprehensive clinical experience of the psychoneuroses. Dr. Dicks describes himself as an eclectic in the field of psychopathology, who accepts the fundamentals of Freudian psychoanalysis, but who in common with other British psychotherapists has come to the conclusion that there are many clinical facts which do not fit in with psychoanalytic conceptions. The material on which the book is based was obtained during the treatment of patients, using a modified free-association technique with special stress laid on the working through of early childhood experiences. All the author's points are fully illustrated by case histories, and as far as this is at all possible, short of publishing complete treatment protocols, the accounts are lucid and convincing.

From the study of the psychopathology of anxiety states, obsessional states, hysteria, sexual perversions, and drug additions the author is led to postulate that there are three early and basic biological needs; apart from sexual tendency and aggressiveness corresponding to the libido and the death instinct of one stage in Freud's evolution of thought, he regards as more fundamental a "third instinct" of self-preservative tendency. This instinct of security is ultimately based in both sexes on the relationship to the good, protecting, nourishing mother. The element dread of loss of the mother expresses itself in infantile anxiety which, according to Dicks, constitutes the common denominator of all neuroses; the various neurotic syndromes are merely different ways in which infantile anxiety has been countered by various individuals. To give just one example: sexual perversions are not interpreted in the Freudian way as representing a failure to deal with impulses by reaction-formations; on the contrary, it is thought that many—though perhaps not all—types of sexual perversions in themselves represent reaction-formations against deeper feelings of deprivation and loss of the mother or the breast, and an attempt at recapturing them. From this follows that the therapeutic outlook on the perversions may not be as unpromising as has usually been thought. The aim and rationale of psychotherapy as practised by the author lies in the restoration of the sense of security for the fulfilment of the individual's emotional demands and needs. The analytic transference acts in the first instance by re-establishing this security, and this relationship between patient and therapist becomes the pattern for the development of mature personal relationships with his environment, i.e., the achievement of mental health.

The manner in which the author develops his theme and defines the position he takes up is instructive and thought-provoking, but his wholesale condemnation of the constitutional approach to almost all neurotic disorders will be regretted by readers who

remain convinced that there is such a thing as "neurotic constitution", but that nevertheless patients thus afflicted can be understood and helped along psychotherapeutic lines.

*Felix Post*

### 1372 Psychiatric Research

Cecil K. Drinker et al. Cambridge, Mass.: Harvard University Press; London: Geoffrey Cumberlege, Oxford University Press, 1947. (Harvard University Monographs in Medicine and Public Health, No. 9.) 113 pages; illustrations. 22 x 14 cm. 11s. 6d. [£0.575]

(i) Research at the McLean Hospital; (ii) biochemical problems related to psychiatry; (iii) integration of medical and psychiatric problems; a report of progress; (iv) protocol for a review of psychiatry; (v) psychical seizures; (vi) the psychobiology of psychiatric research.

In this stimulating little book are published six addresses given on the occasion of the opening of the new Laboratory for Biochemical Research at the McLean Hospital, Waverley, Massachusetts. The authors have described different aspects of psychiatric research, allowing themselves more freedom for speculation than they would, perhaps, in their more formal scientific communications. If this makes the book less commendable to the student, it enhances its interest to those who are already familiar with current trends in psychiatry.

The introductory address by Professor Drinker describes the historical development of the modern attitude towards psychiatry as well illustrated by the changes occurring in the mental hospitals of Massachusetts. "Research," he remarks, "is interminably expensive . . . yet, in the end, it has vast potentialities for profit . . ." The address of Dr. Jordi Folch, the Director of the new Biochemical Laboratory, gives a survey of brain function from the biochemical point of view. The chapter is outstanding and gives a masterful account of some of the main problems in this field. He describes in general terms the results of the work on the respiration and utilization of glucose by the brain, stressing the importance in this connexion of the blood-brain barrier. In describing the function of the glial cells he is prepared to credit the view that the astrocytes may function as "nurse cells" for the nourishment of the neurons, a suggestion which has found little acceptance among histologists, but which is nevertheless provocative and may lead to further work. The last part of his chapter is devoted to the biochemical aspects of the growth and development of the nervous system. Here he stresses the need for further research on the fundamental as well as on the clinical problems.

Professor Cobb's address deals with the etiology of neurocirculatory asthenia or "effort syndrome". Considering this as a particular problem in psychosomatic medicine, he emphasizes the importance of the "pluralistic" view of etiology; the factors concerned include those which are hereditary, anatomical, biochemical, and sociological, and are therefore best considered as a simultaneous assault by internist, physiologist, chemist, and psychologist."

Dr. Gasser points out that current developments of thought in philosophy are significant for neuropsychiatry, which needs to be looked at from a wider viewpoint than that from which it is often seen. He expresses the logical positivist thesis that many problems of science are mainly linguistic, involving the meaning and significance of statements. This is particularly relevant to psychiatry, in which too little attention has been given to the meaninglessness of statements which are incapable of verification. "The crucial question is, will not the science of psychiatry develop most rapidly if its reports are so phrased as to by-pass that for which there is no means of observation and subsequent communication."

Professor Wilder Penfield gives a fascinating account of our knowledge of the anatomical and electrophysiological factors related to psychical seizures. He concludes that further advance in psychiatry must depend on the development of the broad field of neurobiology, which includes all the basic sciences. Professor Strecker condemns the "all-or-nothing" attitude, which has led to the indiscriminate misuse of methods of limited application, such as electroshock treatment and prefrontal leucotomy. His essay is a plea for greater flexibility of thought in psychiatry.

It is refreshing to hear a group of distinguished investigators expressing their private views without restraint in terms which are intelligible to those who are not specialists. In a field which has never been dull, this volume provides new interest.

*Derek Richter*

### 1373 Introduction to Group-Analytic Psychotherapy. Studies in the Social Integration of Individuals and Groups

S. H. Foulkes. London: William Heinemann Medical Books Ltd., 1948. xiv + 181 pages. 22 x 14 cm. £1 1s. [£1.05]

Part I. General introduction. Part II. The background. Part III. The group-analytic situation. Part IV. The conductor's contribution. Part V. Survey. Bibliography. Index.

The name "group psychotherapy" is today applied to a variety of methods which cover an even wider range of possible techniques than is the case in individual psychotherapy. The term "group-analytic psychotherapy" has been coined by the author to characterize the distinctive features of his approach in contrast to inspirational, suggestive, didactic, or socio-dramatic group techniques. Group analysis shares with psychoanalysis basic psychopathological concepts. Yet there are essential differences which are stressed to prevent the misconception that group analysis is simply psychoanalysis in groups. The group situation contains therapeutic influences of its own which are not as immediate and actual in individual psychotherapy. The group approach may therefore be the method of choice for many patients.

The analytical group technique has the advantage of combining therapy with an opportunity for the scientific investigation of the mechanisms and forces operative within groups. The author's wide experience both as a Freudian analyst and as a group therapist enables him to make many relevant contributions to the numerous problems of group treatment, whether he discusses such apparently trivial, but nevertheless important, details as the size of groups and the seating arrangement of their members, or the changes produced in the patients' ego, or the specific therapeutic factors in group analysis. His principal object is, however, the exposition of the method of group-analytic psychotherapy, and, in particular, of the role of the therapist or "conductor" which he elaborates from many points of view. Without the conductor's influence the group would cease to be a therapeutic one. His task is therefore of first importance; it is described as "discriminating activity" which has to adjust itself flexibly to varying group conditions, and therefore may range from passive observation to subtle directing or even overt leadership at different times.

Examples of various group meetings illustrate the author's activities as conductor and his motives for them. To the reader, however, who has had no personal experience of the emotional response in therapeutic groups, the dry records of group conversations may appear flat and commonplace, as they fail to convey the living atmosphere—a difficult and perhaps impossible task.

The book is not entirely devoted to the description of analytic groups. Other groups of different size and purpose are described, to demonstrate the wider social implications of the group approach. This digression from the central theme recalls the author's experiences as an Army psychiatrist. He introduced the method of group-analytic psychotherapy at the Northfield Military Hospital, and later co-operated in what has since become known as the "Northfield experiment". This was a venture in hospital administration, based on broad principles of group co-ordination, which succeeded in bringing patients and staff together into a democratic and high morale hospital community of high morale.

The book would have gained if the author had applied more "discriminating activity" to his style of writing and composition which is often vague and diffuse. The unwary reader may miss many relevant thoughts which are obscured by their verbal wrappings.

*F. Kraupl Taylor*

### 1374 Modern Trends in Psychological Medicine 1948

Edited by Noel G. Harris. London: Butterworth & Co. Ltd., 1948. xii + 450 pages; 25 figures. 25 x 17 cm. £2 10s. [£2.5]

(i) The relation of psychological medicine to general medicine (psychosomatic medicine); (ii) the physiology of emotions; (iii) the importance of constitutional factors; (iv) the causative factors in mental disturbances; (v) electrophysiology in psychiatry; (vi) diagnostic measures; (vii) marriage and family life; (viii) the future of child guidance; (ix) psychopathic personality; (x) psychotherapy; (xi) recent technique of physical treatment and its results; (xii) further developments in abreaction; (xiii) modern social and group therapy;



(xiv) principles of mental hygiene; (xv) character formation in relation to education; (xvi) personnel selection; (xvii) mental hygiene in industry; (xviii) rehabilitation and the individual; (xix) psychological medicine and world affairs. Index.

*Modern trends in psychological medicine* is perhaps the most important symposium on mental health to appear since the special issue of the *Journal of Mental Science* published in 1944. In all, there are 19 chapters, each devoted to a separate topic, and each contributed by an author accepted as an authority in that particular field.

The articles cover a very wide range of subjects, from the physiology of the emotions to a study of psychological medicine and world affairs. One of the articles is contributed by a New Zealand worker, and two by Americans; the remaining 16 come from the United Kingdom.

It is one of the more satisfactory features of this symposium that an attempt has been made to cover work in progress in all parts of the United Kingdom. There is here no narrow limitation to the work of one particular school or of one particular region. All specialist workers in psychological medicine should find this book of interest.

G. A. W. A.

### 1375 Contributions to Psycho-Analysis, 1921-1945

Melanie Klein. London: Hogarth Press & Institute of Psycho-Analysis, 1948. (The International Psycho-Analytical Library, No. 34.) 416 pages. 22 x 14 cm. £1 ls. [£1.05]

(i) The development of a child (1921); (ii) the rôle of the school in the libidinal development of the child (1923); (iii) infant analysis (1923); (iv) a contribution to the psychogenesis of tics (1925); (v) the psychological principles of infant analysis (1926); (vi) symposium on child analysis (1927); (vii) criminal tendencies in normal children (1927); (viii) early stages of the Oedipus conflict (1928); (ix) personification in the play of children (1929); (x) infantile anxiety-situations reflected in a work of art and in the creative impulse (1929); (xi) the importance of symbol-formation in the development of the ego (1930); (xii) the psychotherapy of the psychoses (1930); (xiii) a contribution to the theory of intellectual inhibition (1931); (xiv) the early development of conscience in the child (1933); (xv) on criminality (1934); (xvi) a contribution to the psychogenesis of manic-depressive states (1935); (xvii) mourning and its relation to manic-depressive states (1940); (xviii) the Oedipus complex in the light of early anxieties (1945). Bibliography. List of patients. Index.

In the past twenty years two subjects have gained special prominence among psychoanalysts: psychological development during the earliest phases of infancy, and the manic-depressive and schizophrenic psychoses. To both subjects Melanie Klein, in London, has made original contributions. Now collected in a special volume, they give testimony to the author's devotion to psychological research and to the courage with which she has penetrated into a field of psychology where more stress has to be laid on hypotheses than on objective data. The author is convinced that certain mental processes in the infant's early life are identical with certain morbid mental changes encountered in psychotics. She writes of "the depressive position" of the infant child, of its flight from this into manic excitement, and of painful states perceived by the infant in the form of "persecution fantasies". From the changes in the infant's behaviour, which accompany its happiness and sadness, she believes she has learned how to picture "the inner world of the psychotic patient". Thus early mental development in its relation to psychological conflict and abnormalities in later life becomes for her full of meaning and dramatic possibilities. While these theories and observations are earnestly discussed among psychoanalysts, they have been definitely accepted only by those who have been working in close co-operation with the author. Without such contact familiarization with her approach seems impossible or, at least, difficult. The likelihood is not remote, however, that one day psychiatry will be able successfully to contact the psychotic, for his benefit, through what it has learned from the psychology of infants.

W. Hoffer

### 1376 Psychoanalysis Today

Edited by Sándor Lorand. London: Allen & Unwin Ltd., 1948. xvi + 404 pages. 22 x 14 cm. £1 5s. [£1.25]

(i) Freud's influence on medicine; (ii) psychoanalysis and internal medicine; (iii) psychosomatic medicine; (iv) therapeutic approach to psychosomatic problems; (v) child analysis; (vi) the early development of conscience in the

child; (vii) child-parent relationship; (viii) prevention of mental disease in childhood; (ix) juvenile delinquency; (x) psychoanalytic social work; (xi) mental hygiene; (xii) development of the ego-psychology; (xiii) dream mechanisms and interpretations; (xiv) sexuality and its rôle in the neuroses; (xv) hysterias and phobias; (xvi) obsessional neuroses; (xvii) character formation; (xviii) pathological character formation; (xix) war neurosis; (xx) neuroses and psychoses; (xxi) manic-depressive psychoses; (xxii) schizophrenias; (xxiii) organic psychoses; (xxiv) the technique of psychoanalytic therapy; (xxv) psychotherapy and psychoanalysis; (xxvi) the psychology of religion; (xxvii) psychoanalysis and sociology; (xxviii) problems of crime; (xxix) approaches to art; (xxx) psychoanalysis and literature (xxxi) psychoanalysis and anthropology. Index.

Some fifty years ago, in studying the phenomena of hysteria, Freud searched for a method which could replace hypnosis and lessen the physician's dependence on the patient's suggestibility. This book shows that since these early beginnings psychoanalysis has penetrated into every aspect of life, individual and social, healthy and morbid.

Not without justification has psychoanalysis been called the microscopy of the mind. Like interrogation of the patient in the state of hypnosis or like narco-analysis it can bring to consciousness—while not interfering with the state of consciousness itself—thoughts, feelings and memories which had been unconscious, of which the patient was not aware. Psychoanalysis possesses the revealing and at the same time frightening qualities of a microscope, which makes the invisible visible, be it structure, pathogenic agencies or morbid changes. Psychoanalysis not only reveals the modes of mental functioning, the intrinsic dangers which threaten our mental equilibrium, but also the healing power of insight into and awareness of those unconscious processes which are mainly centred round the memories which connect us with the past.

*Psychoanalysis today* is an atlas of such microscopy of the mind. Twenty-nine psychiatrists and psychologists have joined with the editor in his endeavour to present a comprehensive summary of psychoanalytic research and practice. Medical application plays a major part in this volume. It opens with four papers written by pioneers in the field of psychosomatic medicine. Special attention should be paid to those pages which describe the rôle of psychosomatic factors in the establishment of chronic disease patterns in patients who seek help while the illness is still reversible. This is an important aspect which balances the emphasis thrown on cure in contrast to the prevention of diseases.

Preventive measures are mainly discussed in the essays which depict the child's emotional development as it is encountered in child analysis, in the parent-child relationship and in mental diseases of childhood. Delinquency too plays an important rôle both from the curative and from the preventive point of view.

The psychiatrist will find a variety of papers dealing with such obtrusive factors of modern life as neuroses, perversions and character abnormalities. All the light psychoanalysis has been able to throw on to the understanding of the psychoses, including the "organic psychoses", is carefully recorded by renowned psychiatrists. No attempt is made to give instruction in the technique of treatment in detail, but two papers convey much information on therapy.

Modern medicine has now accepted the main concepts of psychoanalysis and is about to integrate them. Some misconceptions will still have to be rectified, and in doing so this volume will certainly be of great value. It is well adapted to add authoritative information to what the medical profession has learned about psychoanalysis from hearsay and sketchy teaching. But physicians should not be surprised if they find other professional groups equally keen to make use of psychoanalytic principles. They have been found most fruitful by educationists, social welfare workers, and scientists, who attempt to understand the origin of religious feelings and artistic creativeness, and especially in sociology and anthropology. While *Psychoanalysis today* has not been able to deal with all these applications, those which are presented are set forth in lucid and authoritative statements.

W. Hoffer

### 1377 Modern Psychiatry in Practice

W. Lindsay Neustatter. Second edition. London: J. & A. Churchill Ltd., 1948. viii + 275 pages. 21 x 14 cm. 12s. 6d. [£0.625]

Section I. Psychopathology. (i) Psychopathology—general; (ii) psychopathology—the different schools of thought. Section II. Disorders of children. (iii) Anxiety in children; (iv) behaviour disorders; (v) disorders of speech; (vi)



disorders of bladder and bowel control; (vii) mental deficiency; (viii) modern methods of treatment in children; (ix) vocational guidance (by Jack Jennings, B.A.). Section III. Neuroses and psychoses in adults. (x) Anxiety states; (xi) obsessional states; (xii) hysteria; (xiii) depressive states, mania and suicide; (xiv) psychopathy; (xv) paranoid states; (xvi) schizophrenia (dementia praecox); (xvii) the common organic psychoses; (xviii) abnormality of the endocrine system; (xix) abnormalities. I. Normal sexuality and dysfunction; (xx) abnormalities. II. Sexual malfunction (the perversions); (xxi) neuro-psychiatry and psychiatric sequelae [sic] of head injury. Section IV. Methods of treatment. (xxii) The approach to the patient; (xxiii) psychoanalysis; (xxiv) shorter psychotherapeutic methods; (xxv) physical therapy and comparisons of methods. Section V. General. (xxvi) Psychology and general medicine; (xxvii) causation and prophylaxis of mental illness; (xxviii) the law, and some problems of disposal. Index.

The first edition of this little introduction to clinical psychiatry was entitled *Modern psychology in practice* and was published in 1937. The present edition has been partly rewritten and reflects the author's further experience of civilian and service psychiatry. The section on psychiatric disorders of children is sensible and particularly helpful. There are new chapters on psychopathy, neuropsychiatry and on physical therapy. The whole constitutes a readable and entertaining account suitable for the general practitioner, nurse, social worker and schoolteacher. The medical student will be helped to a fuller understanding of both his psychiatric and non-psychiatric patients, and will be stimulated to further reading by the author's communicated enthusiasm. The views expressed are often unorthodox and so will not always commend themselves to examiners.

It has been Dr. Neustatter's aim to present his subject without recourse to technical jargon. His style is refreshingly original and light-hearted, but it is regrettable that his spelling and syntax must be similarly described. To those unfamiliar with the literature it will be irritating to read the names of authorities without any directions for tracing the relevant publications, and in a work for the uninitiated a list of references for further reading would be helpful. In the description of electro-convulsion therapy the stated voltage of 10 should read 100 volts.

H. G.

## RADIOACTIVE SUBSTANCES ACT

### 1378 Radioactive Substances Act, 1948. 11 & 12 Geo. 6. Ch. 37

London : His Majesty's Stationery Office, 1948. 12 pages. 24 x 15 cm. 4d. [£0.0165]

(i) Powers of Minister of Supply in relation to radioactive substances; (ii) control of importation and exportation of radioactive substances; (iii) control of sale and supply of radioactive substances; (iv) control of use of irradiating apparatus for therapeutic purposes; (v) safety regulations for occupations involving radioactive substances and irradiating apparatus; (vi) Advisory Committee; (vii) power of entry and inspection; (viii) offences and penalties; (ix) regulations and orders; (x) power to revoke or vary Orders in Council and orders; (xi) expenses of Ministers; (xii) interpretation; (xiii) application to Scotland; (xiv) application to Northern Ireland; (xv) short title.

The Radioactive Substances Act, 1948 establishes a most necessary control over the manufacture, sale and use of radioactive materials, and also over the use of irradiating apparatus "of a prescribed class or description" on human beings.

Power to produce, purchase, store, transport and dispose of radioactive substances is vested in the Minister of Supply under Sections 1 and 2. Section 3 of the Act is of the greatest interest to medical practitioners. Under it, the sale or supply of more than a certain quantity of any radioactive substance is forbidden when this is intended for therapeutic use on human beings unless by a qualified and specially licensed medical practitioner or by a registered pharmacist supplying "under the authority of a prescription signed and dated by any practitioner licensed as aforesaid". This restriction applies except in the case of a few specified exceptions.

The maximum quantities of different radioactive substances permitted to be sold freely will become known later in regulations made by the appropriate Minister after consultation with an Advisory Committee established under Section 6 of the Act. The licensing of practitioners under Section 3 is (in England and Wales) by the Minister of Health. Applications for licences must be made in writing to the Minister of Health within three months from a day to be appointed by the Minister. Until the practitioner is notified of the Minister's decision on the licence, the provisions of the Section will have effect as if the licence had been granted.

For the use of certain classes of irradiating apparatus on human patients, practitioners will have to be licensed under Section 4 of the Act. The types of irradiation apparatus are not specified in the Act, but they would no doubt include machines such as cyclotrons which can produce a stream of highly energetic ionizing particles.

Provision is made in Section 5 of the Act for the issue of regulations to protect from chance exposure to ionizing radiations persons employed where radioactive substances are produced, stored or used. The safe disposal of radioactive waste is also provided for. This is a problem which will become increasingly serious as the therapeutic use of radioisotopes is extended.

The Act is a well-thought-out and wise measure which should ensure that supplies of radioactive substances are readily available for use in research and medicine. At the same time, the public is safeguarded against avoidable exposure to ionizing radiation, and against commercial exploitation by the ignorant or the unscrupulous.

W. J. Arrol

## RADIOLOGY

### 1379 Modern Trends in Diagnostic Radiology

Edited by J. W. McLaren. London : Butterworth & Co. Ltd., 1948. xxi + 464 pages; 381 figures. 25 x 17 cm. £3

(i) Meaning of speed and contrast in X-ray materials; (ii) safety in the radio-diagnostic department; (iii) vision by X-rays; (iv) radiology in research; (v) radiographic diagnosis of tumours of the pharynx and larynx; (vi) occupational diseases of the lungs; (vii) pulmonary haemosiderosis; (viii) significance of segmental lesions in the lung; (ix) primary tumours of the lung; (x) the status of radiology in lung tuberculosis; (xi) post-operative chest complications; (xii) sarcoidosis; (xiii) radiology of the heart; (xiv) principles of kymography; (xv) modern trends in gastro-enterology; (xvi) colonic disease in children; (xvii) radiology of the gall-bladder; (xviii) renal tuberculosis; (xix) urethrocytography; (xx) tumours of bone; (xxi) vertebral disc lesions; (xxii) abnormalities of the spine; (xxiii) bone changes following irradiation; (xxiv) some aspects of ventriculography and encephalography; (xxv) cerebral angiography; (xxvi) the eye and radiology; (xxvii) foetal abnormalities (in utero and after birth); (xxviii) aspects of hydatid disease; (xxix) applications of diagnostic radiology in radiotherapy; (xxx) blood changes; (xxxi) the law relating to the practice of radiology. Index.

To keep constantly abreast of the progress of modern medicine is a difficult task. There have been so many recent advances in our knowledge of the causation of disease during the last ten years that to attempt to cover the whole field of medical literature would, however desirable, be an impossible task. In consequence one is apt to confine one's reading to one's own specialty and to neglect the wider sphere of general medicine. All workers in medicine have their own particular subjects in which they have accumulated a large store of knowledge, larger than the average worker, and to hear these views expressed in an authoritative article is more valuable than any review of the literature, however exhaustive that might be. To summarize these subjects in a small space will allow one to become conversant with all the modern work with the minimum of effort and yet leave a field for further research in the references provided by the author.

Dr. McLaren has accomplished this task in *Modern trends in diagnostic radiology*—the fourth book to be published in a series which has become extremely valuable and successful. He has not attempted to summarize the work of others, but has persuaded the authors to contribute exhaustive articles from their own store of knowledge; these he has collected together and edited. There can be no doubt that he has selected his authors with the greatest care and has persuaded them to say the maximum amount in as small a space as possible and to illustrate their articles well.

There is so much in the book that it is difficult to pick out any particular part for mention. The early chapters deal with technical problems, advantages and advances of the modern x-ray film, and the need and methods of providing adequate protection for workers in x-ray departments.

The editor himself contributes two sections to the book. The first is on the use to which x rays have been put in the field of research and the possibility of their extended use in the future, and the second on the indications and the value of examination by kymography. In the chapter on research he deals with the work which has been done with x-ray micrography in the study

of the circulation, and the value of x-ray cinematography. Articles follow on the soft-tissue radiography of the larynx and pharynx in the diagnosis and delineation of tumour masses. An excellent chapter on occupational diseases of the lung follows, in which the author enumerates and describes the conditions. He gives a warning about attempts to diagnose silicosis by the 35 mm. film. Further papers follow dealing with the early diagnosis of pulmonary tuberculosis by means of x ray and the evaluation of this method, the chest complications following surgery, and a very authoritative article on the subject of sarcoïdosis. All the papers cover the extent of our present knowledge and summarize the accepted views. There is a long paper on cardiac radiology which is particularly well illustrated and is of great interest. The modern methods of examination of the gastrointestinal tract are reviewed in relation to diseases of the stomach and bowel, with an exposition of modern views. Cerebral arteriography and the value of encephalography and ventriculography are fully dealt with; the latter paper, the last one to be published by Lysholm, deserves a high place of honour. The paper on the early diagnosis of renal tuberculosis is particularly valuable.

Papers are included on irradiation injuries and their detection, the legal implications of medical and radiological practice, bone tumours and the bone changes they cause, and the blood changes associated with the use of radiation. All these are valuable contributions of the highest order.

There is much to be said in praise of this book: it is excellently illustrated, well produced and bound, and the only criticism one can offer when reaching the end is that despite its 464 pages the book is still too short. Its reception will surely stimulate the author and the publishers to make the publication of a book of this type a yearly event.

P. H. Whitaker

### 1380 The Treatment of Malignant Disease by Radium and X-rays: Being a Practice of Radiotherapy.

Ralston Paterson. London: Edward Arnold & Co., 1948. ix + 622 pages; 33 figures. 24 x 17 cm. £2 5s. [£2.25]

(i) General principles; (ii) determination of treatment policy; (iii) choice of technique, time and dose; (iv) calibration of X-ray plant and choice of operating prescription of X-ray treatment; (vii) beam-director system; (ix) construction of ray beam direction applicators; (x) the reaction to radiation; (xi) the skin; (xii) the lip; (xiii) the mouth; (xiv) the pharynx and larynx; (xv) head and neck—various; (xvi) secondary lymph nodes; (xvii) the oesophagus; (xviii) the lung and mediastinum; (xix) the breast; (xx) the uterine cervix; (xxi) the body of the uterus; (xxii) the bladder; (xxiii) the rectum and the anus; (xxiv) the genital organs; (xxv) bone and connective tissue; (xxvi) the reticulo-endothelial system; (xxvii) the blood; (xxviii) the brain; (xxix) causes of failure of treatment; (xxx) telerradium therapy; (xxxi) protection of staff from radiation effects; (xxxii) organization; (xxxiii) research on the biological action of radiation; (xxxiv) new radiotherapeutic agents. Index. Radium dosage graphs.

Paterson's book on the treatment of malignant disease by radium and x rays is the first of its kind to be published in Great Britain. It completes a trilogy of which the two preceding volumes have consisted of (i) a statement of results and (ii) an account of the system of radium dosage. Like the centre from which they emanate, the volumes have shown an expanding tendency and this last volume is an ambitious, beautifully produced publication of which the author may be justifiably proud. It is really a series of monographs describing the conceptions of the Manchester School, and their rationale and methods of treatment in dealing with malignant disease. Other methods and other ideas are given little consideration for, as the author states in the introduction, "... there are many alternative, equally well-founded approaches to the various problems", and the book must be considered as "... one particular practice of that specialty in which it is hoped that a reasonable synthesis of most that is well-tried has been achieved." But no apology is needed, for as a clear, dogmatic but reasonable statement describing the principles, reflecting a wide experience of the treatment of cancer on the basis of sound clinical knowledge and unremitting scientific effort, it will be difficult to equal and well-nigh impossible to surpass. The author warns us, however, and the reader will do well to remember, that he deals with an "evolving specialty" and that the "dogmatic" presentation should be taken as definiteness of statement, not fixity of opinion. An account is given of radiotherapeutic principles, principles on

which treatment policy is based, the techniques used and the apparatus necessary. Clear accounts are given of the radium dosage system and adequate graphs and tables included for moulds and implants, to make the book useful for practical reference. Indeed the keynote of the book is that enough detail is provided for Manchester techniques based on Manchester principles to be carried out by the radiotherapist who masters its contents.

In a book of more than 600 pages it is not possible to give a comprehensive list of all the points which occur to the reviewer in connexion with matters of detail, but in addition to the virtues mentioned above, the following are noteworthy. The stress laid on the necessity of nursing and adequate diet, together with the practical details, is an excellent feature. The chapter on field selection and prescription is interesting and useful, although to the reviewer it seems that the principles followed involve undesirable irradiation of normal tissues.

Criticisms which might be made are numerous, but for the most part are of omissions for which the author excuses himself in the introduction. However, it does not seem to accord with his principles to consider that the x-ray treatment dose given to a larynx in five weeks should be equal to or less than, for instance, the radium dose given to a tongue in a few days. No mention is made of the use of coagulation for vulval carcinoma. The difference between permanent seed implants and radium implants is not emphasized and the possibility of using unequally loaded radium needles as an important advance in technique is not mentioned.

The collaborators who have contributed special chapters are worthy of the author. The radiotherapists are Margaret Tod, on gynaecological and reticulo-endothelial conditions, J. L. Dobbie on x-ray field selection, Walter Levitt on treatment of blood conditions, and B. W. Windeyer & J. E. Roberts on telerradium treatment. Edith Paterson contributes a review of radiobiological work, and Geoffrey Jefferson in his own masterly style adds lustre to the book by his account of tumours of the central nervous system. Help with the physics has been given by W. J. Meredith. It is undoubtedly a book for all radiotherapists.

Frank Ellis

### 1381 Radiotherapy and Cancer

A. G. C. Taylor, Joan Lassetter & T. K. Morgan. London: H. K. Lewis & Co. Ltd., 1948. 81 pages. 22 x 15 cm. 7s. 6d. [£0.375]

Part I. The basis and methods of treatment. Physics—Radiobiology—The intention of treatment—Records—Methods of treatment. Part II. The treatment of cancer in individual sites. A histological classification—Buccal cavity and pharynx—Digestive organs—Respiratory organs—Female genital organs—Male genital organs—Urinary tract—Skin—Nervous system—Eye—Endocrine glands—Sarcoma.

These notes, written by the radiotherapists of the Wessex Radiotherapy Board, which controls the radiotherapy at Southampton, Bournemouth and Portsmouth, were written primarily to enable radiotherapists in the region to have a common statement of classification, principles and methods of treatment so that they could pool their experience and make the best use of their limited physical service. They are also intended to give physicians, surgeons and general practitioners an understanding of the radiotherapist's point of view in the treatment of cancer, as it was thought that this information might stand them in good stead when advising their patients and would contribute to the success of team work in the treatment of this group of diseases.

The first part explains the mode of action and the effects of radiation, the basis of selection of cases for treatment and the methods employed. The second part gives the authors' views on the treatment of cancer according to site, extent of spread and microscopical structure. The notes are clear and well set out, but so compressed that the sections on physics and biology will be of little value to those with any knowledge of the subject and can hardly produce much enlightenment in those with none. That the methods of treatment are set down by sites shows that much care and thought have been given to these problems and that a high standard of treatment is maintained. Such brief statements may be of value as general guides but there is also no little danger that they may lead to the impression that tumours and not patients are being treated.

Surgery is briefly mentioned in places where it is put forward as an alternative method of treatment, but does not, for instance,

receive any mention as a method of treatment for the primary tumour in cases of carcinoma of the alveolus. A regular quantitative estimation of prolan A excretion in the urine in all cases of tumours of the testicle is advocated in a section which occupies one quarter of the whole of the note on testicular tumours. In carcinoma of the bronchus it is suggested that plain x rays, tomographs, bronchograms and examination of the sputum for malignant cells should all be done before bronchoscopy is performed in a suspected case. Ewing's tumour is listed as a histological entity, a reticulo-endothelial tumour which resembles sympatheticoblastoma.

Such individual criticisms naturally arise from the method of presentation and do not necessarily detract from the value of these notes as a guide to the organization of treatment by radiation amongst a group of radiotherapists who meet regularly for discussions.

D. W. Smithers

## REHABILITATION

### 1382 The Rehabilitation of the Injured. Vol. 2: Remedial Gymnastics

John H. C. Colson. London: Cassell & Co. Ltd., 1947. xii + 556 pages; 439 figures. 22 x 14 cm. £1 10s. [£1.5]

(i) Introductory. Part I. The theory of specific remedial exercises. (ii) The classification of movement; (iii) the mechanics of active movements; (iv) basic principles of specific remedial exercises; (v) the aims of specific remedial exercises and the methods used to accomplish them; (vi) the application of specific remedial exercises. Part II. The rationale of specific remedial exercises. (vii) The relationship of the pathological changes which take place in the tissues after injury to the purposes of specific remedial exercises. Part III. The relationship of specific remedial exercises to splints and plaster casts. (viii) Types of splints and plaster casts used for the commoner bone and joint injuries. Part IV. Specific exercises with special remedial apparatus. (ix) Assisted movements with apparatus; (x) resisted movements with apparatus; (xi) essentials of pulley and suspension therapy apparatus. Part V. Specific remedial exercises in the treatment of the commoner bone and joint injuries. (xii) Fracture and fracture-dislocation of the ankle joint; (xiii) fracture of the shafts of the tibia and fibula; (xiv) fracture of the external tuberosity of the tibia; (xv) fracture of the patella; (xvi) injuries of the semilunar cartilages; (xvii) fracture of the shaft of the femur; (xviii) fracture of the neck of the femur; (xix) injuries of the pelvis; (xx) fracture and fracture-dislocation of the dorso-lumbar spine; (xxi) fracture and fracture-dislocation of the cervical spine; (xxii) fracture of the clavicle; (xxiii) dislocation of the shoulder joint; (xxiv) fracture of the shaft of the humerus; (xxv) dislocation of the elbow joint; (xxvi) fracture of the head of the radius; (xxvii) fracture of the shafts of the radius and ulna; (xxviii) injuries of the wrist joint; (xxix) injuries of the hand and fingers. Part VI. The treatment of amputation stumps. (xxx) Amputation stumps: the physiotherapist's part in their preparation for limb wearing. Part VII. Re-education in walking. (xxxi) Theoretical and practical aspects of re-education in walking in the treatment of lower limb injuries. Index.

One of the most significant changes which has taken place within recent years, in the treatment of cases of injury, is the importance which is now assigned to the early and progressive use of remedial exercises, given under skilled supervision and with scrupulous regard to exact methods of technique. It is not so very long ago since absolute rest and rigid immobilization were regarded as the essentials of treatment of any fracture or serious injury. But prolonged rest and immobilization are far from ideal for the recovery of physical function. They lead only too readily to wasting of muscles, stagnation of the circulation, swelling and stiffness of joints, and decalcification of bones. As a result, a fracture so treated is usually followed by a prolonged period of weakness and impaired mobility, and, only too often, by some permanent disability.

It is to counter these ill effects that physiotherapy is now extensively employed in cases of injury, and with excellent results. In the first instance this took a somewhat passive form, and was mainly confined to massage and the application of various forms of heat and electrical stimulation, with the patient having everything done for him by the kindly masseuse. But this has now been superseded in all the more modern schools by the early use of voluntary exercises, directed towards the promotion of healthy circulation in the injured part, the recovery of muscular use and power, and the prevention of adhesions or stiffness.

The development of a scientific technique, in the application of remedial exercises to all forms of injury, owes an immense debt to Mr. John Colson, and the present volume is the result of continuous study of the subject for many years, and to practical experiments carried out in some of the leading hospital rehabilitation centres in the country. With the aid of an excellent series

of photographs and of over 400 attractive line diagrams Mr. Colson describes in detail the type of exercise (or, rather, the course of exercises) required for every kind of fracture or other serious injury, the technical points to be observed, the progression to be followed, and the amount of time to be devoted to each exercise. In each case the actual results of the injury are carefully described and the essential aim of the exercise pointed out. Additional chapters on the classification and mechanics of movement and the basic principles of remedial exercises supply the scientific background to the system of remedial gymnastics recommended, and valuable contributions are also made by Mr. J. M. Fitton and Dr. Langdale Kelham, who, respectively, describe in detail the methods of re-education for the patient who has lost the lower limbs, and the treatment of amputation stumps.

This book should be carefully studied by all who are responsible for the treatment of injuries, whether as surgeons, physiotherapists or remedial gymnasts. A similar volume is needed describing the exercises suitable for non-traumatic forms of physical disability.

Harold Bolme

### 1383 Rehabilitation of the Physically Handicapped

Henry H. Kessler. New York: Columbia University Press; London: Geoffrey Cumberlege, Oxford University Press, 1947. xi + 274 pages. 24 x 15 cm. £1

Part I. Problems of the physically handicapped. (i) General considerations; (ii) problems of the disabled; (iii) the crippled child; (iv) the injured worker; (v) the disabled veteran; (vi) the chronic disabled. Part II. Principles of rehabilitation. (vii) Physical restoration; (viii) rehabilitation centers; (ix) vocational guidance; (x) vocational training; (xi) selective placement. Part III. Rehabilitation in practice. (xii) The mentally and emotionally disabled; (xiii) the orthopedic patient; (xiv) the blind and the deaf; (xv) medical and surgical invalids. Part IV. A national program. (xvi) Legislation and administration; (xvii) a national challenge. Bibliography. Index.

The first rehabilitation centre to be established in the United States was the New Jersey Rehabilitation Clinic, Newark. It was opened in 1919, for the after-care and physical reconditioning of ex-Service men disabled from the First World War, and its first Assistant Director (and subsequent Director) was Dr. Henry Kessler. He continued in that post until 1941, when called up for active duty as a Lieutenant Commander in the United States Navy, in which capacity he organized two of the chief naval rehabilitation centres. The present volume is the product of that wide experience, and provides one of the fullest and most comprehensive accounts of rehabilitation in the USA that has yet appeared.

The book is divided into four parts, dealing respectively with the problems of the disabled, the principles of rehabilitation, the operation of rehabilitation in actual practice, and the part which it should play in a national programme of social security, with a summary of the main laws which have been passed by Congress for the benefit of the physically handicapped, and the actions which have derived from them.

Some of the finest passages in the book are those describing the effect of severe disability on those afflicted: the sense of isolation and inferiority commonly felt by the blind and deaf, the frustration experienced by the seriously disabled in the cutting off of activity and ambition, and the lack of understanding displayed by the general public. As Kessler says of one such group, "they die a hundred spiritual deaths daily".

The essential parts of a well-co-ordinated programme of rehabilitation—expert medical and surgical treatment, physical restoration, vocational guidance and training, and selective placement in work which will provide outlet for the maximum use of physical and mental capacity—are fully and well described, and accounts are given of their application to crippled children, orthopaedic and traumatic disabilities, the mentally and emotionally unstable, and to chronic medical and surgical disorders.

Although mainly confined to the United States, where the main emphasis in rehabilitation has always been on provision for the disabled ex-service man rather than on the far larger and more needy population of civilian disabled, Dr. Kessler presents a broad and sympathetic approach to the whole problem. He has caught a vision of the true function of rehabilitation, not just as a means of employing, in some subsidiary capacity, the man who would otherwise be dependent on charity, but as a method of reintegrating the personality and restoring the functional powers

of the physically handicapped man, preparing him for a sphere of life in which his disabilities will no longer prove a handicap, and conserving for the nation a valuable source of man-power in every department of productive work.

Harold Balme

## RENAL DISEASES

### 1384 Glomerular Nephritis: Diagnosis and Treatment

Thomas Addis. New York: The Macmillan Company, 1948. xix + 338 pages; 58 figures; 1 plate. 24 x 16 cm. £2

(i) Special clinical laboratory methods for the physical examination of patients with renal disease; (ii) special clinical dietetic methods; (iii) inferences as to the nature of the renal lesion; (iv) inferences as to the extent of the renal lesion; (v) the theory of the differentiation of glomerular nephritis from other diseases; (vi) the differentiation of glomerular nephritis from other diseases; (vii) glomerular nephritis; (viii) theory and practice in the treatment of glomerular nephritis. Appendix. References. Index.

This book summarizes the experience of a worker who has devoted over 40 years to the study of nephritis, and for this reason alone it deserves attention. Addis's approach is clinical, backed up by laboratory techniques so simple that they are available to everybody. These techniques are clearly described. Stress is laid on a careful quantitative examination of the urinary sediment in deciding on the nature of the disease process and its activity, and in the book is collected information on the formed elements of urine in various diseases, which would be difficult to find elsewhere. Of particular interest is the section dealing with the course of nephritis. The only comparable long-term study is that of Ellis and, while there is agreement on many points, Addis clearly does not agree with Ellis's differentiation of two types of nephritis.

The section on treatment is the most important and deserves attention. The thesis is developed that, during all phases of nephritis, the osmotic work of the kidney should be reduced to a minimum. Experimental work on animals is presented in support of this view and the dietary management in the various phases of the disease described.

The book is, however, not without its defects. It is marred by the inclusion of unnecessary philosophical considerations which make it difficult to separate out the relevant material. The style is too diffuse and condensation would have allowed of presentation of more factual information. Many important aspects of nephritis are ignored. For example, no mention is made of the cardiac or pulmonary manifestations of acute nephritis which are so often the presenting features and which are responsible for many of the deaths in the acute phase. In the section on treatment some space might have been devoted to other possible interpretations of the experimental findings and more should have been said on the water and mineral needs of the patients in the various phases of nephritis. These and other omissions make the whole presentation rather unbalanced but, despite this, it is a book that can be recommended to those interested in the problems of renal disease.

G. M. Bull

### 1385 New Ways of Treating Uraemia. The Artificial Kidney, Peritoneal Lavage, Intestinal Lavage

W. J. Kolff. London: J. & A. Churchill Ltd., 1947. 112 pages; 59 illustrations. 24 x 16 cm. 10s. 6d. [£0.525]

Part I. Artificial kidney. (i) Brief survey of attempts at blood- (and tissue-) purification in renal uraemia; (ii) the artificial kidney as it is used now in the clinic; (iii) technical experiences with the artificial kidney gained in clinical use, and hints for the use of the kidney in future; (iv) clinical pictures, in which treatment with the artificial kidney is to be considered. Survey of the first 25 patients treated with the artificial kidney; (v) the clinical symptoms of uraemia during and after the dialysis; (vi) reactions of the patient during dialysis and their therapy; (vii) investigation on substances which were removed (or supplied) by the dialysis with the artificial kidney; (viii) instructions for fitting up and cleaning the artificial kidney. Summary of Part I: artificial kidney. Appendix (Plans). Literature. Part II. Peritoneal lavage. Part III. Treatment of serious chronic uraemia by perfusion of an isolated intestinal loop. Part IV. Treatment of uraemia with high caloric low protein diets.

The author begins by stating in this work, published in 1947, that the artificial kidney is probably the most effective means of

removing non-colloid particles from circulating plasma by diffusion. The older methods proposed and used by other workers are described in detail, the main difficulties having been due to the absence of a harmless and reliable agent for the prevention of clotting, the unreliability of the earlier dialyzing membranes and the insufficient capacity of the dialyzing systems.

The present type of artificial kidney, as used by the author, is described in detail. A big cylinder rotates in a tank filled with fluid, a long tube of cellophane is wound round this cylinder spirally and blood from the patient flows through the tube. Continuous dialysis only is now used by the author. The details of construction and drawings given should enable any good instrument maker to reproduce the machine. The fluid used in the tank consists of tap water with 0.6 per cent NaCl, 0.04 per cent KCl, 0.2 per cent NaHCO<sub>3</sub> and 1.5-2 per cent glucose added.

The author considers that any acute uraemia with a blood urea of over 350 mg. per cent, raised blood potassium, or decreased alkali reserve, warrants treatment by the artificial kidney. Of the first series of 15 patients so treated, only 1 survived, but the deaths are shown not to have been due to treatment by the kidney; of the second series of 10, 4 have survived. The largest amount of urea removed in a single dialysis has been 260 g. During dialysis, the blood potassium, sodium, chloride and alkali reserve must be closely followed.

Short chapters are added dealing with peritoneal lavage, the technique of perfusion of an intestinal loop and with the high calorie/low protein diet in the treatment of uraemia. No mention is made, however, of the now quite frequently used method of continuous intestinal lavage; and the advantages or otherwise of the available methods are not fully discussed in a comparative fashion.

G. Loewi

## RHEUMATISM

### 1386 Textbook of the Rheumatic Diseases

Edited by W. S. C. Copeman. Edinburgh: E. & S. Livingstone Ltd., 1948. viii + 612 pages; 351 illustrations. 24 x 17 cm. £2 10s. [£2.5]

... the nomenclature and classification of the rheumatic diseases; (i) the skin and subcutaneous tissues in relation to the rheumatic diseases; (ii) the anatomy and physiology of pain; (iii) the clinical approach to pain; (iv) the anatomy and physiology of joints; (v) climatic and environmental factors in the rheumatic diseases; (vi) rheumatic fever (acute rheumatism); (vii) chorea (St. Vitus's dance); (viii) rheumatoid arthritis; (ix) some aspects of Still's disease; (x) osteoarthritis; (xi) the rarer arthritic syndromes; (xii) spondylitis; (xiii) gout; (xiv) non-articular rheumatism; (xv) brachial neuritis; (xvi) sciatica; (xvii) the differential diagnosis of rheumatism; (xviii) special pathology of the rheumatic diseases; (xix) clinical pathology of the rheumatic diseases; (xx) the radiology of the rheumatic diseases; (xxi) radiotherapy in the rheumatic diseases; (xxii) physiotherapy in the treatment of the chronic rheumatic diseases; (xxiii) hydrotherapy and spa treatment; (xxiv) principles of the orthopaedic treatment of arthritis; (xxv) special problems in the orthopaedic treatment of arthritis; (xxvi) psychiatric aspects of the rheumatic diseases; (xxvii) social and industrial aspects of rheumatism; (xxviii) statistics of the rheumatic diseases. Index.

In the past decade, the medical profession in Great Britain has become increasingly aware of the importance of rheumatism as a cause of painful disability to the individual, and of economic damage to the community. One result of this has been the creation of rheumatism research departments by the Universities of Manchester, Leeds and Bristol, in association with the neighbouring spa hospitals of Buxton, Harrogate and Bath; another has been an increased emphasis on the subject by medical teachers generally. Research workers and teachers alike have regretted the absence of a really comprehensive textbook of the rheumatic diseases: here at last is a serious attempt to produce such a book.

Dr. Copeman has chosen to write with a team of contributors, and, although this is unusual for a book on an apparently narrow specialty, it is essential if authoritative views are to be given on the influence on diagnosis or treatment of physiology, neurology, pathology, radiology, orthopaedics, psychiatry, and social and physical medicine.

The book begins well with an historical summary by the editor, and with fundamental sections on the significance of pain, by J. H. Kellgren, and the anatomy and physiology of joints, by D. V. Davies. The standard is maintained by chapters on the commoner rheumatic disorders—including acute rheumatism,



by Lord Horder, chorea, by the editor, and osteo-arthritis, by E. R. T. Fletcher. At first sight, there would appear to be a lack of balance in the allocation of 57 pages for Professor Cohen's fine chapter on gout, and of only 23 pages for Professor Davidson's concise account of rheumatoid arthritis, but this is adjusted by the separate description of Still's disease, by B. Schlesinger. In the same way, the apparent inadequacy of 8 pages for Sir Adolphe Abrahams' differential diagnosis of rheumatism is compensated by the allowance of 52 pages for Professor Cohen's admirable section on the rarer arthritic syndromes.

The value of the specialist-contributor is well shown by the sections on special and clinical pathology, by H. J. Gibson, on radiology, by Campbell Golding, and on the often-underestimated hydrotherapy and spa treatment by G. D. Kersley; only by "scissors and paste" methods could a general physician write chapters of such accuracy and understanding. The general principles of the orthopaedic treatment of arthritis are clearly described by Sir Reginald Watson-Jones & H. Osmond-Clarke, but their chapter on special problems in such treatment suffers a little from compression—which is perhaps inevitable in a primarily medical work.

In brief, the book goes far to meet a real need, and should be welcomed by the general physician as well as by the specialist in the rheumatic diseases and in physical medicine. Although one feels that a smaller team of contributors might have been more satisfactory, Dr. Copeman deserves great credit for his editing, which has reduced overlapping to a minimum and given adequate references and a bountiful supply of excellent illustrations.

The book is produced by Messrs. E. & S. Livingstone, of Edinburgh, and is in keeping with their high reputation.

D. N. Ross

## SOCIAL MEDICINE

### 1387 Changing Disciplines. Lectures on the History, Method, and Motives of Social Pathology

John A. Ryle. London: Geoffrey Cumberlege, Oxford University Press, 1948. x + 122 pages; 13 figures. 19 x 13 cm. 12s. 6d. [£0.625]

(i) Social pathology and the new age in medicine; (ii) the social post-mortem examination and its bearing on aetiological research; (iii) teaching and research in social medicine. An account of the Oxford experiment; (iv) the meaning of normal and the measurement of health; (v) social medicine and the population problem, (vi) medical ethics and the new humanism. Index of authors and references. Index of subjects.

At this stage in the development of social medicine in Great Britain this book can claim a peculiar interest. The author was the first in this country to occupy a chair of social medicine. Moreover, the Institute of Social Medicine at Oxford, of which he is the director, was created in order that through experiment and experience the scope and content of the subject should be given a more exact definition. It became Professor Ryle's responsibility to give direction to its development. This being so, it follows that the results of his experience, when presented, must do much to mould the organization and function of all the other academic departments of social medicine which have come into being in Britain since the war.

It was fortunate, therefore, that the mounting interest in social medicine in America led to a visit of Professor Ryle to the USA, where he was invited to state his creed and display his philosophy. It was fortunate for the reason that in preparation for this visit he was forced to crystallize some of his ideas which have been shaped by the growth of his Institute. None could have better qualifications for these tasks than the author, for he had not only seen in his own lifetime those changes within medicine which had yielded in the end the new discipline of social medicine but he himself had, by his reactions to these changes, been persuaded to transfer his own interests from clinical and personal medicine to new ventures in the field of social pathology.

Professor Ryle has formed the opinion that though medicine, with its scientific and technical advances, has greatly increased in respect of its powers, it has at the same time become less competent to deal with certain of the deeper personal needs of the individual and the broader social needs of the community. He

is persuaded that medicine cannot rest content to be concerned in the main with the phenomena of clinical pathology, but must once more become competent to deal with the medical problems of the total individual in relation to his total environment, both physical and social.

In this book, which presents the subject-matter of a series of lectures, the author answers a number of questions with which he has been living and makes suggestions as to how medicine in the immediate future may become better able to tackle the new problems that social changes have created.

Whilst in Great Britain there is coming into being a general agreement concerning the content, techniques, scope and aims of social medicine, abroad there is much confusion and misunderstanding. To those who seek a knowledge of what social medicine is and of its relationship to the other branches of medicine this book is strongly to be recommended, for it is a serious and successful attempt to construct and to present a general theory of the subject.

F. A. E. Crew

### 1388 The Natural History of Disease

John A. Ryle. Second edition. London: Geoffrey Cumberlege, Oxford University Press, 1948. xiv + 484 pages. 22 x 14 cm. £1 2s. 6d. [£1.125]

(i) The physician as naturalist; (ii) the training and use of the senses in clinical work; (iii) the clinical study of pain; (iv) visceral pain and referred pain; (v) the study of symptoms; (vi) the nature and relief of some common gastric symptoms; (vii) the natural history of duodenal ulcer; (viii) anorexia; (ix) chronic diarrhoea; (x) fatty stools from obstruction of the lacteals; (xi) observations on colonic pain; (xii) chronic spasmodic affections of the colon and the diseases which they simulate; (xiii) on examining the rectum; (xiv) ball-valve accumulations in the rectum; (xv) visceral neuroses; (xvi) the natural history, prognosis, and treatment of staphylococcal fever; (xvii) the natural history, prognosis, and treatment of streptococcal fever; (xviii) the natural history, prognosis, and treatment of infections with *Bacillus coli communis*; (xix) the prognosis and treatment of lobar pneumonia; (xx) prognosis; (xxi) the radial pulse; (xxii) hyperpiesia; (xxiii) chronic Bright's disease without albuminuria; (xxiv) angina pectoris and allied seizures; (xxv) a note on John Hunter's cardiac infarct; (xxvi) three cases of cardiac distress; (xxvii) thrombophlebitis migrans; (xxviii) notes on prostatic and gastric uraemia; (xxix) myxoedema and other manifestations of thyroid deficiency; (xxx) meningitis and meningism; (xxxi) some alarming seizures; (xxxii) of nosophobia; (xxxiii) observations on the abdominal and circulatory phenomena of allergy; (xxxiv) diathesis, or variation and disease in man; (xxxv) opening remarks at a discussion on research in clinical medicine; (xxxvi) the social pathology of rheumatic fever; (xxxvii) the Hippocratic ideal. Index to authors. Subject index.

A republication of lectures and essays provides interesting and stimulating reading, easily adaptable to occasional and interrupted leisure. Professor Ryle discusses the importance of the qualities of the naturalist and the humanist in the good physician. Recent technical training has perhaps tended to overshadow the importance of the more simple observational methods in clinical medicine; eagerness to measure objectively may lead us to overlook the less measurable but possibly more relevant features of the clinical picture.

Nothing in medicine is so insignificant as to merit inattention . . . But there can be no dispute about the merits of the two methods; they are complementary . . . A series of cases of headache, backache, or abdominal pain, as fully investigated as circumstances will permit . . . may ultimately furnish the material for a reasoned contribution . . . The only essential apparatus for the research is a good card index.

The value of the careful study of symptoms and of the "whole" patient and his environment is illustrated in several essays. Methods of studying pains and common gastric and other visceral symptoms are discussed on the basis of the author's clinical experience. Readers familiar with the 1936 edition will find only minor modifications in its chapters; new chapters cover such general clinical matters as the uses of prognosis (Chapter XX) and both the social and psychiatric aspects of common disease, such as the social pathology of rheumatic fever (Chapter XXXVI) and nosophobia (Chapter XXXII).

The essays are very readable and throughout are fully illustrated from the wide clinical experience on which they are based. The book covers many of the daily practical problems of clinical medicine, and differs from textbooks in its predominant concern with the symptomatology that is both common and incompletely understood. The book should be of interest to all physicians, and should prove particularly helpful to students and practitioners in balancing their digestion of some of the medical "scientific" literature which is both less relevant and less interesting.

T. Russell Fraser



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# 1389 The Social Medicine of Old Age. Report of an Inquiry in Wolverhampton

J. H. Sheldon. London: Published for the trustees of the Nuffield Foundation by Geoffrey Cumberlege, Oxford University Press, 1948. x + 239 pages. 21 x 14 cm. 5s. (paper cover); 10s. (cloth cover) [£0.5]

(i) Introduction; (ii) physical state of old people living at home—I. General; (iii) physical state of old people living at home—II. Local symptoms; (iv) mental state of old people living at home; (v) domestic structure; (vi) the management of illness in the home; stresses and strains; (vii) random reflections. Appendix 1: questionnaire used in the survey. Appendix 2: statistical tables. Index.

There has long been a tendency towards partisanship among both social and medical workers for the old or the young in the community. We were even warned quite recently not to be too lavish in our dealings with the aged lest we take too much attention away from other problems and rob the younger generation of their rights and needs. Here at last, in J. H. Sheldon's *Social medicine of old age*, is a book which makes no attempt to establish a case for or against the aged as a group in need of care and attention.

With unemotional objectivity Dr. Sheldon places his findings before us: (i) that 98 per cent of the old people in his sample lived at home; (ii) that, ill or well, old people at home are subject to certain hazards; (iii) that these hazards, in their turn, threaten the stability and balance of the lives of those who live in association with old people.

Taking a random sample of the population, without regard to health-level or income-level, the author has set out to present a picture of old people in everyday life in an industrial town (Wolverhampton). Contact with such a sample, he points out, greatly enriches the physician's experience, since this is usually confined to those avowedly ill, temporarily or permanently, and seldom includes those carrying on their daily lives, without or with recognized disabilities. Using the technique of the questionnaire filled out in the patient's home by the investigator (in this case Dr. Sheldon himself), he has been able to maintain the freshness of the direct response, augmented by his own close observation during the interview. Important for future investigators is the lesson of infinite patience called for when the interview is hampered by the subject's slowness of comprehension, deafness, over-eagerness for the visitor's company or reluctance to talk to a stranger, and the sharp difference of approach necessary between one subject and another. "For all these reasons, five interviews and the later writing up of the results is the best that can be done in an average full day's work."

Dr. Sheldon follows his study of the physical and mental state of old people at home, the domestic structure in which they live and the management of illness in the home, with an important chapter which he calls "Random Reflections", a title which indicates that he feels there is far to go before we may draw conclusions. Here he touches on what is normal for old age; possible lines of further inquiry; and the important contributions that can be made by the general practitioner. He underlines the incredible determination to live in spite of serious physical defects, loneliness, economic and emotional stresses, and shows how those well occupied seem best able to overcome their disabilities. The value of specific remedial measures, such as dentures, spectacles, hearing-aids, physiotherapy and chiropody, is also discussed. Perhaps Dr. Sheldon's most vital and original contribution to gerontology is that implied in the following paragraph:

The previous chapters have dwelt [sic] in detail with the physical and mental state of the old people forming the sample, dealing essentially with each subject as an individual. No true understanding of the problems of old age in the community could be reached if the inquiry were limited to this individual aspect of old age, and there can be no social medicine of old age without a knowledge of the reciprocal relations between the old people and the community of which they form part.

Without minimizing the burden of old age to the old person, he depicts vividly the cost to those not yet old:

It was found in Wolverhampton that 7.7 per cent of the old people were suffering great strain on the younger generation. . . . The details provided in the text concerning the difficulties experienced by these unfortunates over such simple but necessary matters as time for relaxation, getting out of the house, and still more of getting away for a holiday, speak for themselves. These members of the younger generation are clearly carrying a grossly unfair burden, and any scheme for the betterment of old age that failed to include a consideration of their needs would be lacking in equity.

In these days when "No room at the hospital" has become a slogan repeated ad nauseam, it is well to have it brought home to both medical and lay readers how great a proportion of the work

for old age is to be done outside hospital walls. Above all it is urgent to insist that there is no danger of over-estimating the needs of the old at the expense of other communal needs, if it is remembered that neglect of old age as a social responsibility increases the burden on the young and middle generations. It is to be hoped that Dr. Sheldon has blazed a trail which many will follow.

S. R. Burstein

## SURGERY

### 1390 Radical Surgery in Advanced Abdominal Cancer

Alexander Brunschwig. Chicago: University of Chicago Press; London: Cambridge University Press, 1947. xii + 324 pages; 118 figures. 25 x 17 cm. £2.2s. [£2.1]

(i) Historical; (ii) operable and inoperable carcinoma; (iii) nonsurgical contraindications to radical resections of abdominal cancer; (iv) supportive treatment for patients undergoing extensive intra-abdominal operations; (v) total gastrectomy; transhiatal total gastrectomy; cardioesophagectomy; (vi) total operations in the presence of perforated gastric carcinoma; (vii) operations for recurrent gastric cancer; gastrectomy for metastatic carcinoma (to the stomach); (ix) operations for advanced cancer of the small intestine; (x) operations for advanced cancer of the colon; (xi) carcinoma of the head of the pancreas; (xii) operations for cancer of the body of the pancreas; (xiii) operations for hepatic neoplasms; (xiv) operations for advanced carcinoma of the extra-hepatic biliary ducts; (xv) injuries to the hepatic artery, portal vein, and superior mesenteric vessels; (xvi) operations upon the spleen involved in advanced intra-abdominal cancer; (xvii) operations upon the adrenal gland; (xviii) operations for intra-abdominal extension of gynecologic cancer—complications of irradiation therapy; (xix) results of radical surgical excision in 100 cases of advanced abdominal cancer; (xx) conclusions. Index.

The name of Brunschwig requires no introduction to surgical readers on either side of the Atlantic, and he is especially well known for his pioneer work in relation to malignant tumours of the pancreas.

In Great Britain no surgeon has done more than George Grey Turner to encourage surgeons, especially younger colleagues, to deal with malignant disease vigorously and thoroughly, promising them that their prowess will many times be rewarded, and the reviewer has often said that Grey Turner's little book, *Some encouragements in cancer surgery*, published a quarter of a century ago, should be on every young surgeon's bookshelf. This volume from Dr. Brunschwig's pen carries the same note of encouragement for those who have to deal with cancer. Inasmuch as he confines himself to advanced cancer in the abdomen, there are no formidable rival methods of therapy to contend with and he is at pains to ascertain what surgical courage, fortified with all the recent additions to the surgical armamentarium, can effect in prolonging life, relieving distress, and making the "passing on" more easy for those afflicted with abdominal cancer. Some of his surgical ablations in advanced cancer have been indeed *tours de force*—the removal of stomach, spleen, part of colon, pancreas, liver, etc.

Perhaps the most valuable chapter of the work is that which analyzes the results of operative surgery in 100 patients with advanced abdominal malignancy. 34% died of operation; 17% received no relief; 30% derived relief in varying measure. But he can make the proud boast that 19% i.e., one in five, were rewarded with prolonged survival, 13% averaging nearly 3½ years. One patient, whose stomach, distal half of pancreas, a loop of jejunum and its mesentery and adjacent retroperitoneal tissue were resected, was alive more than ten years later. A similar case also was alive after nine years, and there are others recorded who have survived more than five years.

There is a useful brief history of the evolution of abdominal surgery in the first few pages of the book. Every abdominal surgeon should be the possessor of this volume. Its author expresses his great appreciation to that fine surgeon, Dallas B. Phemister, Fellow of the Royal College of Surgeons of England and President of the American College of Surgeons, for his interest and encouragement.

Gordon Gordon-Taylor

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1391 **British Surgical Practice.** Volume 5  
Under the general editorship of Ernest Rock  
London: Butterworth & Co.  
220 illustrations; 6 plates.

**1391 British Surgical Practice. Volume 5**  
Under the general editorship of Ernest Rock Carling & J. Paterson Ross. London: Butterworth & Co. Ltd., 1948.  
xxvii + 532 pages; 220 illustrations; 6 plates. 25 x 17 cm.  
£3

**91 British Surgical**  
Under the general editorship  
**Paterson Ross.** London : Butterworth,  
xxvii + 532 pages ; 220 illustrations ; 6 plates.  
£3

(i) Hodgkin's disease, other reticuloses, reticulo-sarcoma and myelomatosis;  
(ii) hormones; (iii) hydatid disease; (iv) hyperhidrosis and allied states (v) hyper-  
piesia; (vi) immersion-foot; (vii) impotence; (viii) infection, infections and  
inflammation; (ix) injury—civil and industrial; (x) injury—compression; (xi)  
intestines; (xii) intussusception; (xiii) ischaemia; (xiv) jaundice; (xv) joints—  
arthrography; (xvi) joints—caisson derangements of the knee; (xvii) joints—injuries and acute  
infections; (xviii) joints—internal cysts; (xix) kidney and ureter—denervation  
and ureter—tuberculosis, (xx) kidney and ureter—growths; (xxi) kidney and ureter—  
calculi; (xxii) kidney and ureter—ligatures and sutures;  
hydronephrosis and pyonephrosis; (xxiii) lacrimal apparatus—injuries and diseases;  
and ureter—direct laryngoscopy and aspiration treatment in laryngeal diph-  
theria; (xxiv) larynx—surgical diseases of; (xxv) law in relation to surgery;  
(xxvi) lens—absence of; (xxvii) leprosy; (xxviii) ligatures and sutures;  
(xxix) liver—cirrhosis; (xxx) lymphogranuloma inguinale; (xxxi) lung—tumours;  
(xxxii) lupus vulgaris; (xxxiii) lymphogranuloma inguinale. Index to Volume 5.

The system of surgery of which this is the 5th volume is a  
British one, and the result has been a very high level  
of progress in all parts with Hodgkin's disease at  
both the most interesting and the worst.

The system of surgery, of which this is the 5th volume is a great credit to British surgery. The editors have chosen their contributors very wisely and the result has been a very high level of exposition. This volume starts with Hodgkin's disease and ends with lymphogranuloma inguinale, both most interesting and informative articles. Features which show that the work is well abreast of the times are inclusion of a chapter on the law foot, on compression injury and industrial injuries, while a new and useful outlook is shown by inclusion of a chapter on the lipoidoses but after reading it one wishes that there were fewer conditions needing eponymic terms. Diseases of the kidney are dealt with by six separate experts; though each section is good one almost feels that some unity of outlook is lost by such subdivision. There are long and well-illustrated articles on diseases of the larynx and tumours of the lung. Two of the most concise and informative chapters are on hyperpiesia and physiology of sweating: a masterpiece of compressed but readable matter. We have purposely avoided mentioning the names of the contributors, for it would be invidious to single out any where the general excellence is so high. It is our considered opinion that for any practitioner—since it is authoritative, beautifully produced, and well indexed.

V. Zachary Cope  
see BMB 1275 (*Brit. med. Bull.* 5, No. 4-5, p. 406)  
see BMB 1274 (*see p. 125 in this number.*—Ed.)

V. Zachary Cope \

1392 **Parenteral Alimentation in Surgery: with Special Reference to Proteins and Amino Acids**. London: Hamish Hamilton Medical Books. 1965. 31 figures. 24 x 16 cm. £1 1s.

**Parenteral Alimentation**  
**Special Reference to Proteins and Acids**  
Robert Elman. London: Hamish Hamilton Medical Books, 1966. Pp. xx + 284 pages; 31 figures. 24 x 16 cm. £1 1s.

**Special Reports**  
**Acids**  
Robert Elman. London: Hamish Hamish, 24 x 16  
1947. xx + 284 pages; 31 figures. 24 x 16  
[£1.05]

(i) Introduction; (ii) general indications and methods for the parental administration of fluids; (iii) water and electrolyte needs; (iv) energy (caloric) needs; (v) vitamin needs; (vi) protein needs; (vii) clinical manifestations of protein deficiency; (viii) methods of parental protein administration: plasma transfusions; (ix) methods of parental protein administration: amino acids and hydrolyzed protein; (x) a practical program for parental alimentation; (xi) clinical results with parental alimentation. Appendix: milestones in parental alimentation. Index.

Elman has produced a comprehensive and well-documented intravenous alimentation, ostensibly as applied to the physiologist and pathologist. The original contributions of the author and protein hydrolyzation are likely to be equally instructive to the pediatrician and the pediatric pathologist.

Dr. Elman has produced a comprehensive and well-documented account of intravenous alimentation, ostensibly as applied to the physician or even to the physiologist and pathologist; Dr. Elman himself has made important original contributions in the field, especially on the use of amino-acids and protein hydrolysates, and is thus particularly well qualified to summarize and review critically the considerable literature which has accumulated, especially over the last decade. The first chapter, which gives a short but comprehensive survey of the history of parenteral infusion, makes very pleasant reading and it is obvious that the author has enjoyed writing it. In the chapter on water and salt balance the distinction between dehydration as such and a deficit of electrolyte is emphasized. Another chapter provides a short discussion on caloric needs. Energy requirements in infusion fluids are nowadays met mainly by addition of glucose; however, it has been found difficult to provide in this way more than 600-700

Calories per day, which is obviously insufficient. Recent work by Stare leads one to expect that in the near future fat emulsions might be available which could be used for intravenous injection. The availability of infusion fluids which cover the energy requirements of man without the need to employ excessive volumes of water would greatly increase the scope of intravenous alimentations. Dr. Elman accepts the usual American figures for ascorbic acid requirements; the usual daily requirement, he states, "... has been found to vary between 50 and 150 mg." There is no real experimental basis for the belief that administration of vitamin C to patients who do not show definite clinical signs of vitamin deficiency has beneficial effect. The concept of a "sub-clinical" deficiency is hazy and potentially mischievous and is often used as an excuse for the administration of a variety of vitamin preparations to patients who do not need them.

Probably the most important chapters of the book are those on protein deficiency and its correction by intravenous means. The author does emphasize, as the author should, the importance of feeding should normal channels of feeding have been employed. The tissues of

been found to be of benefit to patients who do not suffer from a deficiency which has beneficial effect. The author does not make any experimental basis to patients who do not suffer from a deficiency which has beneficial effect. The author does not make any experimental basis to patients who do not suffer from a deficiency which has beneficial effect.

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Probably the most important chapters of the book are those dealing with protein deficiency and its correction by intravenous alimentation. It is important to emphasize, as the author does, that whenever possible the normal channels of feeding should be used. Recent work, in which isotopic labels have been employed, has demonstrated the exact chemical nature of these reactions, and the by-passing of the alimentary canal may therefore alter the normal pattern of protein metabolism. There are, however, certain conditions in which feeding by mouth is difficult or impossible and other methods of alimentation must be used, of which intravenous administration is only one. At the present time, when protein hydrolysates are commercially available, the therapeutic value of parenteral administration of proteins tends to be over-emphasized and it appears to the reviewer that Dr. Elman's presentation is not quite free from this fault. Some of the successes claimed for the intravenous treatment may possibly be due to the water and salt supplied to dehydrated patients rather than to the nitrogen administered. The loss of nitrogen which occurs after fractures, operations and other traumata is fully discussed by Dr. Elman. The mechanism of this mobilization of protein is not yet fully understood, but it appears that increase of protein intake by parenteral feeding does not seriously reduce this loss of nitrogen. The question may be asked, whether this apparently physiological response to injury is necessarily deleterious to the patient. It may be preferable to wait until the acute phase is passed and to increase the protein intake during convalescence, when the patient can be fed by the normal route. Dr. Elman's presentation is very clear and persuasive; the printing is good and remarkably free from errors. Altogether the book can be recommended as a stimulating and fairly comprehensive account of an important field of clinical science.

A. Neuberger

**Surgery**

Livingstone Ltd., 19

5s. [L

A. Neuberger

**1393 Retropubic Urinary Surgery.** Edinburgh : E. & S. Terence Millin. 1968 pages ; 163 figures. 25 x 10 cm. £1.75.  
Includes index. Contents: (i) Introduction; (ii) Anatomy; (iii) Pathology; (iv) Investigation; (v) Treatment; (vi) Complications; (vii) Results; (viii) Conclusions; (ix) Summary; (x) References; (xi) Glossary; (xii) Index.

**Retropubic Urinary Surgery** by Terence Millin. Edinburgh: E. & S. Livingstone Ltd., 1947. vii + 208 pages; 163 figures. 25 x 18 cm. £1 5s. (£1.25) net.

**393 Retropubic Urinary Surgery** Edinburgh: E. & S. Livingstone. [E.L.]  
Terence Millin. 163 figures. 25 x 18 cm. £1 5s.  
vii + 208 pages; 163 figures. (i) surgical approaches to the  
prostate; (ii) prostatic obstruction; (iii) retropubic prostatectomy;  
(iv) historical; (v) surgical anatomy; (vi) pre-operative care; (vii)  
(x) post-operative care; (xi) armamentarium; (ix) retropubic prostatectomy;  
stomy; (xii) operative difficulties; (xiii) post-operative prostate; (xiv) the cal-  
sub-cervical and sub-trigonal lobes; (xv) the prostate; (xvi) carcinoma of the  
culous prostate; (xvii) carcinoma of the prostate; (xviii) traumatic rupture of the  
bladder; (xix) post-prostatectomy obstruction; (xx) anaesthesia; (xxi) stress  
posterior urethra; (xii) prostatic abscess; (xiii) anatomical; (xxii) stress  
incontinence in women. Case analyses (Appendices I and II). Index.

This monograph is largely devoted to prostatectomy by the retropubic approach and, thanks to the choice of paper and excellently produced, and, thanks to the various types of type, easy to read. The author describes the various types of prostatic obstruction, and these are illustrated by endoscopic views in colour and photographs of actual specimens. With this description of the morbid anatomy as a basis, the results of surgical approaches to the prostate are reviewed, and the actual surgical approaches to the prostate are reviewed, and the results in each are considered. Retropubic prostatectomy is described in detail, having regard to the surgical care and management of the patient. Each stage of the operation is described in detail and the illustrations are admirably drawn. Millin concludes this section with an analysis of the large number of cases in which he has carried out this operation. There is no doubt that retropubic prostatectomy is a significant forward

step in prostatic surgery, and great credit is due to the author for his brilliant exposition of the operative technique which he has personally developed. The retropubic approach is now a standard method for the removal of the prostate. In the later chapters of the book descriptions are given of total prostatectomy and total cysto-prostatectomy for carcinoma. A brief, though well-illustrated, description of the author's operation for stress incontinence in women is provided in the last chapter. This book should be read by all surgeons interested in modern developments in prostatic surgery.

David Band

### 1394 The Surgery of the Stomach and Duodenum

T. H. Somervell. London: Edward Arnold & Co., 1948. viii + 546 pages; 231 figures. 24 x 15 cm. £2 5s. [£2.25]

(i) Introduction; (ii) embryology of the stomach and duodenum; (iii) anatomy of the stomach and surrounding organs; (iv) physiology of the stomach and duodenum; (v) gastric secretion in the human stomach; (vi) pain in abdominal viscera; (vii) diagnosis of gastric and duodenal diseases; (viii) operative methods; (ix) pre- and post-operative treatment of gastric cases; (x) congenital and infantile conditions; (xi) acute dilatation of the stomach; (xii) some injuries and diseases of the duodenum; (xiv) acute ulcers of the stomach and duodenum; (xv) chronic duodenal and gastric ulcer; (xvi) chronic gastric ulcer; (xvii) chronic duodenal ulcer; (xviii) medical treatment of duodenal ulcer; (xix) surgical treatment of duodenal ulcer; (xx) vagotomy in the treatment of duodenal ulcer; (xxi) gastrectomy for duodenal ulcer; (xxii) treatment of gastric ulcer; (xxiii) complications of gastric and duodenal ulcers; (xxiv) complications of gastric and duodenal operations; (xxv) carcinoma of the stomach; (xxvi) sarcoma and other neoplasms of the stomach; (xxvii) oesophago-gastric conditions; (xxviii) tumours of the duodenum; (xxix) the gall-bladder and pancreas in relation to gastroduodenal surgery. Bibliographic index. Index of subjects.

This monograph on the surgery of the stomach and duodenum has been written by Mr. Somervell, who has had an extraordinarily large clinical experience of this type of surgery during his 23 years' service in a Mission Hospital in South India. There are preliminary chapters on the detailed development, anatomy and physiology of the stomach and a chapter devoted to experiments on the animal stomach. These preliminary chapters are the result of extensive review of the modern literature on this interesting and important subject and the material in the various articles which have been abstracted has been extensively analyzed and is presented in an unbiased and instructive manner. The physical signs, symptoms and methods of diagnosis of gastroduodenal disease are discussed in considerable detail. The pathology and etiology of the various common and rarer diseases in this region are discussed at great length. The treatment of chronic peptic ulceration is considered and a good deal of emphasis is placed on the importance of the operation which was first described by Mr. Wilson Hey of Manchester and popularized by Mr. Somervell, namely, physiological gastrectomy. There is an excellent section on the different alternative methods of treatment which have been and are being performed. Many of these are of mere historical interest and have fallen into disrepute.

There is a section on vagotomy by Mr. I. Morrison Orr which outlines the physiological basis and discusses the experimental work on which this operation is founded; the importance of resting hyperacidity is emphasized. Mr. Orr's own results with vagotomy are analyzed and extensive reference to the results of American workers is made.

Finally, carcinoma of the stomach and oesophago-gastric conditions are discussed, with a short section on the trans-diaphragmatic approach to the stomach.

While one feels throughout the book that the author has been slightly biased by the results of physiological gastrectomy in his practice in India, the book should be of great interest and considerable value to any gastro-enterologist or any surgeon who is particularly interested in surgery of the stomach or duodenum. The illustrations are exceedingly clear and the general standard of production of the book is first-class.

H. W. Porter

### 1395 The Causation and Treatment of Delayed Union in Fractures of the Long Bone

Kenneth W. Starr. London: Butterworth & Co. Ltd., 1947. xiv + 233 pages; 106 figures; 3 plates. 25 x 18 cm. £2 2s. [£2.1]

Part I. The morphogenesis of bone. Section I. The structure of bone. Section II. The chemistry of bone. Section III. The cycle of bone reconstruction. Section IV. The relationship between structure and function in bone

morphology. Part II. The healing of fractures. Section I. The anatomical structures involved in repair. Section II. The process of repair following fractures. Part III. The aetiology and treatment of delayed union. Section I. Historical. Section II. The aetiology of delayed union; the statistics of delayed union. Section III. Adjuvant therapeutic methods. Section IV. The clinical approach. Section V. The treatment of closed fractures. Section VI. The management of open fractures. Section VII. The management of septic fractures. Section VIII. The management of the skin problem. Retrospect and prospect. Appendices. References. Index.

Delay in the union of fractures has occasioned much pathological and clinical research during the present century. Many of the factors which influence adversely the rate of union are now well recognized. In particular, the significance of impaired blood supply, of infection, of separation of the fragments, of inadequate immobilization, and of soft tissue interposition, is widely accepted. Nevertheless, the mode of operation of certain of these factors has remained a subject for discussion.

In this book, which is based upon a Jacksonian Prize Essay of the Royal College of Surgeons of England, Dr. Starr records in detail the observations he has made during a prolonged study of the healing of fractures in all its aspects—pathological, clinical and therapeutic. The material is arranged in three main parts, which deal respectively with the structure and physiology of bone, the pathology of fracture repair, and the causation and treatment of delayed union. The first part includes a straightforward account of the histology of bone, with emphasis on the distinctive features which characterize primary or woven bone on the one hand, and secondary or lamellar bone on the other. An account is given also of the complex biochemical problems of bone deposition and bone resorption. The term "resorption" is used to imply not only demineralization but also changes in the structure of secondary bone, which may become so porous that it resembles primary bone. This process of resorption is brought about by a combination of cellular and vascular activity. Its significance is further emphasized in a discussion on the pathological aspects of fracture repair, which occupies the second part of the book. Resorption of the bone ends is to be regarded as an essential preliminary to their amalgamation with the callus, and as a means by which a local source of bone salts is made available for its calcification. The physico-chemical characteristics of the fracture haematoma and the factors which influence the rate of its development into callus are also discussed. There is much of interest in this section, which many will consider the most valuable part of the book.

The third part, on the causation and treatment of delayed union in fractures, follows well-established principles. No new concept of the causes of delay is presented, nor is there anything unusual in the treatment advocated unless it be a partiality toward intermittent venous congestion and early drilling of the fragments.

In some respects the book leaves a sense of disappointment. Although there is much of interest and importance in the section on pathology, it is difficult to see that the more clinical sections point to any significant advance in our knowledge either of the causes or the treatment of delayed union. It is a difficult book to read, and while the diagrams and some of the photomicrographs are clear, the radiographs are for the most part indifferent.

H. Osmond-Clarke

### 1396 Textbook of Genito-Urinary Surgery

Edited by H. P. Winsbury-White. Edinburgh: E. & S. Livingstone Ltd., 1948. xv + 1046 pages; 451 illustrations. 25 x 18 cm. £4 10s. [£4.5]

(i) The applied anatomy of the kidneys and ureters; (ii) the development of the kidneys and their congenital defects; (iii) physiology and tests of renal function; (iv) examination of the kidneys; (v) abnormal constituents of the urine; (vi) movable kidney (nephroptosis); (vii) aneurysm of the renal artery; (viii) injuries to the kidney; (ix) hydronephrosis; (x) cysts of the kidney; (xi) new growths of the kidney and ureter; (xii) paraneuritic growths: suprarenal growths; (xiii) nephritis from the surgical point of view (the surgery of nephritis); (xiv) operations on the kidney; (xv) surgical anatomy and physiology of the ureters; (xvi) congenital abnormalities of the ureters and the ureteric orifices; (xvii) injury and fistula of the ureter; (xviii) stricture: megaloureter; (xix) operations on the ureter; (xx) the surgical anatomy of the bladder and the physiology of micturition; (xxi) examination of the bladder: catheters; (xxii) disturbances of micturition and variations in the amount of urine excreted; (xxiii) congenital malformations of the bladder; (xxiv) diverticulum—cystocele—prolapse; (xxv) injuries of the bladder; (xxvi) new growths of the bladder; (xxvii) foreign bodies in the bladder; (xxviii) fistulae of the bladder; (xxix) disturbances of micturition resulting from nervous diseases and injuries. Atomy of the bladder; (xxx) operations on the bladder; (xxxi) surgical anatomy of the male urethra; (xxxii) examination of the male urethra; (xxxiii) the development and congenital deformities of the urethra; (xxxiv) injuries of the male urethra; (xxxv) foreign bodies, cysts and fistulae of the male urethra; (xxxvi) new growths of the male urethra; (xxxvii) the female urethra; (xxxviii) the prostate; (xxxix) simple enlargement of the prostate;



(xxxviii) treatment of complications of simple enlargement of the prostate and non-operative treatment of simple enlargement; (xxxix) suprapubic prostatectomy; (xl) Wilson Hey's prostatectomy; (xli) retropubic prostatectomy; (xlii) perineal prostatectomy; (xliii) transurethral resection of the prostate by the McCarthy method; (xliv) transurethral resection of the prostate by the methods in use at the Mayo Clinic; (xlv) fibrous prostate and dysectasia; (xlvi) commentary on the various surgical procedures for the relief of prostatic obstruction; (xlvii) cancer of the prostate; (xlviii) prostatic calculi; (xlix) the seminal vesicles and Cowper's glands; (l) the testicles; (li) imperfectly descended and misplaced testicle; (lii) tumours of the testicle; (liii) tunica vaginalis; (liv) spermatic cord; (lv) the scrotum; (lvi) the penis; (lvii) new growths of the penis; (lviii) inflammation of the penis; (lix) inflammation of the scrotum; (lx) non-specific urethritis and inflammation of Cowper's glands; (lxi) inflammatory urethral stricture; (lxii) prostatitis and prostatic calculi; (lxiii) inflammation of seminal vesicles, epididymis, vasa deferentia and testes; (lxiv) inflammation of the tunica vaginalis; hydrocele; haematocoele; (lxv) cystitis; (lxvi) perleystitis; (lxvii) infections of the kidneys and ureters; (lxviii) perinephritis; (lxix) urinary fever and uraemia; (lxx) the medical treatment of non-specific infections of the urinary tract; (lxxi) leucoplakia and malacoplakia of the urinary tract; (lxxii) non-syphilitic and non-gonococcal venereal lesions of the male genitals; (lxxiii) genito-urinary tuberculosis; (lxxiv) genito-urinary schistosomiasis; (lxxv) hydatid disease of the genito-urinary system; (lxxvi) actinomycosis of the genito-urinary system; (lxxvii) syphilis of the genito-urinary organs; (lxxviii) gonorrhoea; (lxxix) general features of calculous disease of the urinary tract; (lxxx) calculous disease of the kidneys and ureters; (lxxxi) calculous disease of the bladder; (lxxxii) urethral calculi; preputial calculi; (lxxxiii) the management of glycosuria in genito-urinary surgery. Index.

This work is made up of contributions from the leading urologists of Great Britain. Not only is surgical opinion found in the composition, but there are also contributions by physicians on certain aspects of urology. The editor states in the preface that the work covers the urinary tract and the male genital system from a surgical point of view; this has undoubtedly been achieved. Each contributor deals with that section of urology on which he has become expert. The book is essentially practical in its outlook. Discussions on the theoretical aspects are, generally speaking, limited but adequate. The illustrations, line drawings, detailed drawings of operative technique, and also the plates showing pathological states, help to explain the text. The coloured illustrations are well reproduced, and there are numerous particularly fine coloured plates of various types of pathological conditions as seen through the cystoscope. In some cases one would feel that the x-ray reproductions could be improved, though, generally, they are good. More might have been written on the use of streptomycin as a urinary antiseptic, but as the drug has not yet been available in Great Britain it is difficult for the contributors to relate their own experience in this form of therapy. There is room for a more elaborate account of the investigation of sterility in the male. For the medical student this is a book of reference; for the general surgeon or the urologist it is an essential part of his equipment. The editor is to be congratulated on compiling such a wealth of expert opinion from so many eminent sources, and covering so wide a field.

morbid anatomy, symptoms, diagnosis and treatment dealt with. The methods of treatment described are perhaps somewhat conservative but a special chapter is devoted to the more recently developed fungicides and fungistatics. A useful list of media is appended. A special word of commendation must be given to the excellent photographs and coloured plates, which will be of great practical value to those who are called upon to deal with mycotic infections, especially in the tropics and subtropics.

In a very few places the information requires bringing up to date: no reference, for instance, is made to the diagnostic use of histoplasmin or to the frequency of pulmonary lesions caused by *Histoplasma capsulatum*—lesions which are liable to be confused with tuberculosis. As an introduction to a field which has up to now been poorly explored this work will be of great and lasting value.

G. M. Findlay

### 1398 *História da Lepre no Brasil. Volume II. Período Republicano (1889-1946). Album das Organizações Antileprosas*

Heracleides-Cesar de Souza-Araujo. Rio de Janeiro: Imprensa Nacional, 1948. xx pages + 380 plates. 33 x 23 cm.

The first volume of this monumental work by Professor de Souza-Araujo traced the history of leprosy in Brazil from 1500 to 1889 and was the subject of an essay-review in *British Medical Bulletin*, 1947, 5, 233 (BMB 1125). The whole work is to be completed in three volumes, of which this is the second. This volume cannot be adequately reviewed separately, because it is really an album of photographs, the letter-press referring thereto being reserved for the final volume. The author's original idea was to produce the letter-press and the corresponding illustrations together, but this was not found feasible and the decision was reached to issue the photographs in one volume and the letter-press in another.

As originally visualized, the period of 57 years (1889-1946) was to be divided for purposes of description into three parts: the first to 1920, that is, before the time when modern prophylactic measures came into effect; the second, comprising the succeeding decade, during which the DNSP (Departamento Nacional de Saúde Pública) took up the question of inspection for prophylaxis; the third, which is called the "Getulian Period" because it is that of the governorship of Dr. Getulio Vargas, from 1931 onwards, during which prophylactic measures were intensified.

To bring out pictures and letter-press in one volume would have made the book unwieldy; to have brought it out in two parts would have destroyed the unity of this second period of the history. It will be clear, however, that the true value of this second volume can be properly appreciated only when the third volume appears. In order to make the work as complete as possible, the author sent out questionnaires to Directors of the Leprosy Service in the various centres. Many replied, but, as is usual when questionnaires are sent, some took no notice of the request for information. Thus, most of the photographs in this volume—there are more than a thousand on 380 plates—are original and many of them have been taken by the author himself. When no replies were received Professor de Souza-Araujo has had to use illustrations from the photographic archives of the Federação das Sociedades de Assistência aos Lázaros.

The whole forms a record of a most interesting itinerary undertaken by the author; he has personally visited many of the institutions referred to and taken the photographs on the spot himself. These show, for the different States of Brazil, the buildings, the inmates, different stages of the disease, the people at work and enjoying leisure, happy children at play and in congenial employment. There are also photographs depicting congresses and conferences, weddings and other festivals.

There are already 38 leproseries in Brazil and another was under construction in Bahia when this book was issued. Six of them are in Minas Gerais and five in São Paulo. There are 27 preventoria, or institutions for the care of children of the afflicted, and in Acre Territory yet another is being established. Minas Gerais had four of these and São Paulo three. Each has on its staff a director and a leprologist and 15 of them have also a paediatrist, so that the children are well looked after.

It is not possible to comment on the pictures individually and where all are so clearly reproduced it would be difficult and

## TROPICAL MEDICINE

### 1397 *Mycoses and Practical Mycology. A Handbook for Students and Practitioners*

N. Gohar. London: Baillière, Tindall & Cox, 1948. xi + 234 pages; 134 figures; 4 colour plates. 22 x 14 cm. £1 5s. [£1.25]

(i) Mycology; (ii) the mycoses; (iii) mycetoma; (iv) blastomycosis; (v) mycoses of the digestive tract; (vi) sporotrichosis.

Medical men are, on the whole, well supplied with textbooks on pathogenic bacteria and protozoa, but much less information is available on the parasitic fungi. Mycology, in fact, has been the Cinderella of modern medicine. This handbook has been written with the object of supplying both the dermatologist and the general practitioner with a concise clinical and practical guide to mycotic infections. This end has been attained and, in addition, precision has been given to a subject upon which there has long existed confusion regarding not only nomenclature but the identification of many pathogenic fungi.

Two introductory chapters deal with such general questions as the classification of fungi, their structure and reproduction, habitats, modes of infection and the reactions of the hosts to the fungi no less than the reactions of fungi to their hosts. The various fungal infections are then described *seriatim*; each condition is defined, its geographical distribution is discussed and its

invidious to choose any for special mention. All who are fortunate enough to possess the first two volumes of this great work will look forward eagerly to the third which, says the author, is in an advanced stage already. A further tribute must be paid to Professor de Souza-Araujo for his generosity in giving the proceeds of the sale of this volume, just as he did in the case of Volume I, to the International Leprosy Association, thereby benefiting every part of the world where sufferers from this horrible disease are to be found—a philanthropic act beyond all praise and for which thousands will be grateful.

H. Harold Scott

### 1399 The Leptospiroses

P. H. van Thiel. Leyden: Universitaire Pers Leiden, 1948. x + 231 pages; figures. 24 x 16 cm.

(i) The morphology of the leptospirae; (ii) classification; (iii) diagnosis and technique; (iv) general epidemiology; (v) general and special prophylaxis; (vi) pathogenesis of the leptospiroses; (vii) clinics and therapy of the leptospiroses; (viii) Leptospirosis icterohaemorrhagiae; (ix) Leptospirosis canicola; (x) Leptospirosis grippotyphosa; (xi) Leptospirosis pomona; (xii) Leptospirosis sejo; (xiii) Leptospirosis hebdomadis; (xiv) Leptospirosis autumnalis; (xv) Leptospirosis pyrogenes; (xvi) Leptospirosis bataviae; (xvii) Leptospirosis icterohaemoglobinurica; (xviii) Leptospirosis schöffneri; (xix) Leptospirosis andaman A; (xx) Leptospirosis australis A; (xxi) other strains that are not yet sufficiently identified; (xxii) leptospiroses caused by strains, only found in animals and perhaps, partly, occurring in man. Tables. Explanation of the figures. Bibliography. Index of authors.

During the past few years it has slowly become apparent that leptospiral infections are of very considerable importance both in man and in animals. Yet, since the monograph written by Professor A. Pettit in 1928, little or nothing has been done to collect and analyze the great mass of information which has accumulated, more especially as a result of work in Holland. This book, written in English by Professor van Thiel of Leyden, will therefore be widely welcomed, since it fills a long felt want. It was largely compiled, it appears, during the war years when information of what was being done in other countries was not easy to obtain: this perhaps accounts for the paucity of references to studies carried out after 1940. The book is particularly valuable, however, in that it gives a full account of studies in Holland and Indonesia.

After a short introduction, the morphology and classification of *Leptospira* are discussed, methods of diagnosis are described and a very lucid description of epidemiology is given. Methods of general prophylaxis are at this stage probably of more value than attempts at specific immunization, in view of the importance of using strictly homologous strains freed from foreign protein for protection. Only a brief account of treatment by antibiotics is provided, though it is concluded that there is every reason to administer penicillin "when no serum is available or to shorten the course of a relatively mild case of leptospirosis." The various species of *Leptospira* pathogenic for man and animals are then described. Although haemoglobinuria is produced in cattle by *Leptospira bovis*, the existence of leptospiral blackwater fever in man is perhaps less certain than the author suggests. The book concludes with a not very helpful table of the geographical distribution of the leptospiroses—it is scarcely worth while to be told that *Lepto. icterohaemorrhagiae* exists in Africa—a list of the animals known to carry *Leptospira*, references, and an index of authors: there is no subject index. Occasionally the English is a little involved, e.g. in such sentences as "... we uphold the point of view that a form of blackwater-fever exists being a leptospirosis next to a form closely allied to an infection with malaria..." The English reader also may be left guessing whether "French Guyana" refers to French Guinea, as here suggested, or French Guiana: it is perhaps over-optimistic to be able to exclude malaria "anamnestically".

Despite these minor blemishes this book contains a great deal of information well set out and not otherwise easily available.

G. M. Findlay

### 1400 O'Meara's Medical Guide for India and the Tropics

H. W. Williamson. Fifth edition. London: Butterworth & Co. Ltd., 1947. viii + 882 + 46 pages; 35 illustrations. 22 x 14 cm. £1 10s. [£1.5]

It is now over ten years since the 4th edition of this work was published, and its steady growth is now carried on to meet the

changed scene presented by developments in medical practice and public health administration. In the preface the author pays tribute to the Indian Medical Service, and the variety of information presented in the book reflects the scope of the work that confronted a civil surgeon in the Provinces of India, functioning as physician, surgeon and civil administrator, removed from access to specialists and forced to embrace daily almost every aspect of the practice of medicine. The book might be regarded as a memorial to the passing of that Service, and it should bid fair to take a place in the armamentarium of medical officers carrying on in fields similar to those once ploughed by many of its officers in civil employment.

The presentation and substance are encyclopaedic, subjects being arranged in alphabetical order. The work contains a wealth of medical information on medicine, surgery, obstetrics and gynaecology, ophthalmology, and laboratory methods. The needs of the rural prescriber are supplied in much useful pharmaceutical information and a simple but comprehensive, formulae. There are concise sections by specialist contributors, and these embrace much diverse information that is seldom so ready to hand, and often requires to be sought elsewhere. Three pages on the applications of medical electricity, for example, are highly informative, and notes on nursing will be found compact and comprehensive to those whose duties include the care of subordinate staffs. The encyclopaedic aspect of the work is well reflected in the large amount of miscellaneous information included but not pertaining directly to the practice of medicine. The reader will discover, *inter alia*, how to preserve eggs, remove stains, how to render fabrics fire-proof, and a table giving dosage of over seventy drugs for elephants, camels, horses or mules, cows, goats, sheep and dogs.

Civil health administration, medicolegal work and lunacy are largely represented by details of Indian procedure, but much of it can be adapted readily to requirements anywhere, and this aspect of the work is little detrimental to its use in other continents. Some of the information on foodstuffs pertains essentially to the subcontinent, and the Indian bias found in the choice of tropical diseases dealt with is a deterrent to its wider use as a work of reference in tropical medicine. For example, information on filariasis is scanty and trypanosomiasis finds no mention.

Much criticism is forestalled by the author's frank admission in the preface that when such a wide range of subject matter is treated by one author the quality must vary. The details given of certain surgical procedures are disproportionate in relation to the scant mention of others of equal or greater importance in emergency surgery. The college student in the Far East, to whom previous editions of the work are familiar, will still find the book in its new form well worth carrying around with him although he may here and there discover isolated statements that will fail to satisfy an exacting examiner. It is to be hoped he will appreciate the touches of humour which lighten the pages. This book will yield much information on the management of sick people and suggest many ideas for the organization of an efficient rural medical establishment.

J. Bennet

### TUBERCULOSIS

#### 1401 Bovine Tuberculosis: Including a Contrast with Human Tuberculosis

John Francis. London: Staples Press Ltd., 1947. 220 pages; 36 illustrations. 22 x 14 cm. £1 5s. [£1.25]

(i) The incidence of tuberculosis; (ii) pathogenesis; (iii) tuberculosis of bovine origin in man; (iv) detection of tuberculous cattle; (v) vaccination against tuberculosis; (vi) the control of bovine tuberculosis. Summary and conclusions. References. Index.

Mr. Francis has shown considerable courage in undertaking a broad review of the present position in regard to pathology and pathogenesis of tuberculosis in the bovine and in the human, since his knowledge of human tuberculosis is, on his own admission, entirely derived from textbooks and not from practical experience.

There is a great need for combined research between veterinary surgeons and physicians into the epidemiology of diseases like tuberculosis which affect both animals and man,



suspensions of penicillin, and it is hoped that most would disagree with his advice to practise "... prolonged deep massage [presumably of the site] after injection" of penicillin in an oil-wax suspension. Some more precise instructions on the management of oily and oil-wax suspensions would have made the book more helpful to the practitioner. The first two chapters are on uncomplicated gonorrhoea in the male; they describe methods of treatment, including the use of sulphonamides, in vogue before the advent of penicillin, and end with: "The most effective therapeutic agent in cases of sulphonamide-resistant gonorrhoea is penicillin", for information on which the reader is referred to Chapter IX. Today this seems very much like putting the cart before the horse. Chapter III is on local complications of gonorrhoea in the male, tests of cure, relapse, and "secondary (non-gonococcal) infection", which is dealt with again and in more detail later in the book. Chapter IV deals with gonorrhoea in the female and its local complications. Chapter V is chiefly on metastatic complications of gonorrhoea and Chapter VI is on vulvo-vaginitis in children. This is followed by a chapter on stricture of the male urethra—it seems difficult to understand why stricture should be separated from gonorrhoea in the male by chapters on gonorrhoea in females and on metastatic complications of gonorrhoea in both sexes. Chapters VIII and IX respectively are on sulphonamides and the use of penicillin in gonorrhoea. Chapters X—XIX describe the diagnosis and treatment of syphilis in the pre-penicillin era and Chapter XX provides 11 pages on the penicillin treatment of syphilis which should be read in the light of the literature on the subject that has appeared since the proofs of this chapter left the author's hands. Chapter XXI, slightly over two pages, is on the prognosis of syphilis. It contains some statements which will not meet with general agreement, such as that inadequate treatment, which is defined as less than twenty injections of a trivalent arsenical, "... appears to give results worse than no treatment at all." This is not supported by soundly conducted statistical studies and is definitely contradicted by those of Paul Rosahn (*Amer. J. med. Sci.* 1937, 193, 534) and of J. E. Kemp & K. D. Cochems (*Amer. J. Syph.* 1937, 21, 625). Part III deals with chancroid, lymphogranuloma inguinale, granuloma venereum, non-gonococcal urethritis, Reiter's syndrome, phimosis and paraphimosis, balanoposthitis, warts, scabies, trichomonad infestation, and ulcus vulvae acutum, which together occupy 25 pages. The advice to treat inguinal bubo complicating chancroid by wide incision cannot have been derived from practical comparison of this method with aspiration and injection. The section on skin tests in lymphogranuloma inguinale makes no mention of antigens prepared from other sources than lymphogranuloma inguinale buboes.

Part IV deals in 31 pages with irrigation, anterior urethroscopy, dark-ground examination, collection of blood, intravenous and intramuscular injection, lumbar puncture, dorsal slit and circumcision, fever therapy, and personal prophylaxis. The illustrations are generally good and for the most part the teaching is sound, but, as already indicated, the book would have been much more useful for students and practitioners if penicillin had been blended into the treatment schemes as closely as is, for example, the metallic treatment of syphilis.

L. W. Harrison

## VIRUS DISEASES

### 1404 *Les Ultravirus des Maladies Humaines.* Volumes I & II

C. Levaditi, P. Lépine et al. Second edition. Paris: Librairie Maloine, 1948. viii + 1907 pages; 368 figures; 3 colour plates. 24 × 16 cm. Paper covers, 6,500 fr.; boards, 7,000 fr.

This is the second edition of a textbook originally published in 1938. To keep pace with the many developments since that date the text has been extensively rewritten, and revised to the end of 1947. Many new articles are included and in consequence there are 728 additional pages and the work is now divided into two volumes. As in the previous edition, the senior authors

have written only some of the sections, the others being the work of a number of collaborators. It is essentially a book for laboratory workers, and is not an exhaustive survey with complete bibliographies. The aim has been to present a series of critical expositions, each by a worker who has himself made contributions in the field of which he writes. This method certainly makes the book very pleasant to read, but limits its value as a work of reference.

The book opens with two sections discussing the general nature of viruses. The first of these, by Dr. Levaditi, is unchanged from the first edition, but the second, by Dr. Gratia, has been extensively rewritten and provides a most stimulating critical survey of the whole field, including bacteriophage and plant viruses. There follow a number of sections dealing with individual human virus infections. These vary very much in the amount of detail which their authors have felt it necessary to include, and the extent of the revision reflects the amount of work which has been done in each field during the past 10 years. Thus, for example, the sections on vaccinia, variola, herpes simplex and herpes zoster are, in the main, unchanged, whereas the articles on poliomyelitis and yellow fever have been rewritten and expanded. In this edition the section on rickettsial diseases has been omitted entirely and although the reasons for this are quite understandable, since there has been such an enormous amount of work published during the last 10 years, yet psittacosis and lymphogranuloma inguinale are retained, and in the reviewer's opinion the three cannot be logically separated. There is no mention of trachoma.

There are new articles on eastern and western encephalomyelitis, Russian spring and summer encephalitis, epidemic hepatitis, atypical pneumonia, common cold, mumps, measles, rubella, warts, molluscum contagiosum and, rather debatably, on infectious mononucleosis. In addition the article on influenza has been entirely rewritten. All these articles are excellent in their way, but differ considerably in the amount of detail included. The new articles on the viruses causing encephalomyelitis are very sketchy and the section on influenza is a very simplified account. On the other hand the article on atypical pneumonia is a detailed study of the present complicated position.

Following the sections on specific virus diseases, there are a number of articles dealing with technical methods. These bear evidence to the rise of electron microscopy since the last edition, the extensive use of lyophil drying and the development of egg techniques for the cultivation of viruses.

It is a pity that the section on experimental techniques is so much confined to intracerebral methods and does not mention some of the hazards of intranasal inoculation. In the previous edition the article on tissue culture was by the late Dr. Harry Plotz. This has been entirely rewritten on a most ambitious scale by Dr. Wirth, and there is a new and excellent section on the irradiation of viruses. Finally there is a useful article on diagnostic methods.

There is no systematic discussion of bacteriophages even though the general articles assume a considerable knowledge of these agents. Also the rigid exclusion of all virus diseases of animals makes some of the chapters of less value than they might otherwise be. Frequent reference is made to a work published in 1943 called *Les ultravirus des maladies animales*, but in practical laboratory work on human virus infections it is impossible to avoid close consideration of the virus diseases of laboratory animals.

There is no fixed method of collecting the references. In some sections the references are printed at the bottom of each page, in other sections they are printed at the end. The index is not sufficiently detailed for a work of this magnitude, being in fact little more than an expansion of the list of contents.

In this new edition the number of illustrations has been considerably increased, but as the work is now printed on very poor paper, the reproduction leaves much to be desired. There are now three colour plates, i.e., two additional to the original one, but as both the new plates illustrate polyhedral disease of silk worms they seem redundant in a work of this type.

This textbook maintains a high standard; in some parts it should provide a useful work of reference, and in others should give a succinct exposition of the present state of knowledge to someone not familiar with that field. Unfortunately, the price makes private ownership practically impossible.

Forrest Fulton



## VOLUNTARY SOCIAL SERVICES

1405 **Voluntary Action: a Report on Methods of Social Advance**

Lord Beveridge. London: Allen & Unwin Ltd., 1948. 420 pages. 22 x 14 cm. 16s. [£0.8]

Part I. The mutual aid motive in action. (i) The friendly societies; (ii) the State and the friendly societies; (iii) mutual aid in other forms. Part II. The philanthropic motive in action. (iv) The voluntary social services and their development; (v) a chapter of pioneers; (vi) charitable trusts. Part III. The needs that remain in a social service state. (vii) The changing environment of voluntary action; (viii) some special needs that remain; (ix) some general needs that remain. Part IV. Conclusions and recommendations. (x) The future of voluntary action; (xi) the State and voluntary action; (xii) first things first. Appendices. Index.

Lord Beveridge's Report on Social Insurance and Allied Services (1942) was concerned with action by the State to achieve security for the individual in sickness and old age; on its findings is based the National Health Service Act, 1946. The present volume *Voluntary action* shows what has been, is being, and can be done, independent of the State.

Such activities are conveniently divided into those whose motive is mutual aid among members of a group or society and those which are philanthropic in nature. The former includes Friendly Societies whose members, in return for weekly payments, receive aid in time of need. This subject is dealt with in detail, for it has been sadly neglected; the last book on it was published in 1891 and the last comprehensive study was that of a Royal Commission, published in 1874. There is also a brief description of Hospital Contributory Schemes which in 1943 had a subscribing membership of about 10 millions and an income of over £6,500,000. Membership of these schemes provided the patient with free treatment in hospital, surgical appliances and grants towards the cost of convalescence, and at the same time assured the hospitals of a steady income.

The second motive for voluntary action, philanthropy, has led to the development of a variety of institutions in which contributions aid members of the community as a whole. These include the St. John Ambulance Association and Brigade, which is available for first-aid treatment in accidents and emergencies; organizations for child welfare, such as The National Society for Prevention of Cruelty to Children and Dr. Barnardo's Homes; for youth, e.g. the National Association of Boys' Clubs, the Young Men's Christian Association; for old people and for physically handicapped persons such as the blind, crippled, deaf and tuberculous.

Another subject dealt with fully is that of charitable trusts founded on money bequeathed for specific purposes. Some of these date back to the 16th century and legal problems arise as to their disposal in modern times, with regard to the wishes of the testator. The last fifty years have seen the foundation also of large trusts, wisely administered by trustees who have a liberal measure of freedom. Such include the Carnegie United Kingdom Trust (1913), the Pilgrim Trust (1930) and the Nuffield Foundation (1943). This last is the largest, with an endowment of £10,000,000. It is doing much for medicine by the establishment of Nuffield Departments in various branches of medicine at Oxford and by the granting of fellowships and scholarships in Great Britain and the Dominions. Another wealthy trust is the King Edward Hospital Fund for London, which was formed by public subscription in 1897 as a national memorial to Queen Victoria's Diamond Jubilee. This fund has made grants for hospital maintenance and for medical education and research. Now that the State has taken responsibility for the maintenance of hospitals, the administrators of the fund plan to devote more to the other two objects.

An interesting biographical section is devoted to "pioneers" in social welfare who arose to tackle the evils consequent upon the rapid industrialization which the 19th century brought. We are reminded that it was Elizabeth Fry who, in 1840, made "the first attempt in England to train and standardize nurses and nursing on a professional basis", and are told that "Florence Nightingale took some of the 'Fry Nurses' with her in the first band that went to the Crimea."

Part Three of this book deals with the needs that still remain now that so many which were left to private action have become a public responsibility. It is emphasized that these needs mainly arise through the increasing leisure of wage earners and the growing complexities of modern life.

In conclusion it is urged that the State should, in every way, encourage voluntary action for social advance. Such action must be activated by a sense of vocation and individual responsibility for it to be fully effective.

D. F. A.

## PARTICULARS OF BOOKS REVIEWED ELSEWHERE IN THIS NUMBER

The numerals in square brackets are the serial numbers of the articles in which these books are reviewed

[1308] **Hallmarks of Mankind**

Frederic Wood Jones. London: Baillière, Tindall & Cox, 1948. vi + 86 pages; 23 illustrations. 22 x 14 cm. 10s. 6d. [£0.525]

[1309] **A Study of Individual Children's Diets**

E. M. Widdowson. London: His Majesty's Stationery Office, 1947. vii + 196 pages; 93 figures. 24 x 15 cm. 6s. [£0.3] (Medical Research Council Special Report Series No. 257.)

(i) Introduction; (ii) description of the present investigation; (iii) the children's food; (iv) contribution of various foods to the total caloric intake, and the consumption of foods in terms of man-values; (v) caloric intakes and caloric requirements; (vi) protein, fat and carbohydrate; (vii) calcium requirements, calcium allowances and calcium intakes; (viii) phosphorus; (ix) iron; (x) vitamins; (xi) effect of locality upon the type and variety of foodstuffs consumed, and upon the chemical composition of the diet; (xii) boarding school diets; (xiii) school meals; (xiv) twins; (xv) nutritive value of vegetarian diets; (xvi) comparison of the nutritive value of the diets of thirteen diabetic children with those of healthy children of the same ages; (xvii) comparison of the diets of 38 children of unemployed fathers with the diets of middle-class children. Summary. Acknowledgements. References.

[1310] **The Trend of National Intelligence. The Galton Lecture, 1946**

Godfrey Thomson. London: The Eugenics Society & Hamish Hamilton Medical Books, 1947. (Occasional Papers on Eugenics, No. 3.) 35 pages. 22 x 14 cm. 2s. [£0.1]

[1310] **Psychological Approaches to the Biography of Genius**

Lewis M. Terman. London: The Eugenics Society & Hamish Hamilton Medical Books, 1947. (Occasional Papers on Eugenics, No. 4.) 24 pages. 22 x 14 cm. 1s. 6d. [£0.075]

[1314] **Report on the Work of the School for the Year 1946-1947**

London School of Hygiene and Tropical Medicine. London: London School of Hygiene and Tropical Medicine, 1948. 134 pages; illustrations. 22 x 14 cm.

[1315] **Annual Review of Physiology. Volume IX**

Edited by Victor E. Hall. Palo Alto, California: Annual Reviews, Inc. & American Physiological Society, 1947. vii + 736 pages. 23 x 16 cm. \$6

(i) Growth; (ii) developmental physiology; (iii) reproduction; (iv) metabolic functions of the endocrine glands; (v) the physiology of supporting tissue; (vi) muscle; (vii) exercise; (viii) the visceral functions of the nervous system; (ix) digestive system; (x) kidney; (xi) peripheral circulation; (xii) heart; (xiii) derivatives of blood plasma; (xiv) blood gas transport; (xv) water metabolism; (xvi) physiological effects of heat and cold; (xvii) the respiratory system; (xviii) nerve and synaptic conduction; (xix) bioelectric potentials in the nervous system and in muscle; (xx) electrical activity of the brain; (xxi) the somatic functions of the central nervous system; (xxii) special senses, cutaneous sensation; (xxiii) the experimental neurosis; (xxiv) permeability; (xxv) physiological aspects of genetics; (xxvi) defense mechanisms; (xxvii) pharmacology. Author index. Subject index.



[1315] **Annual Review of Physiology. Volume X**

Edited by Victor E. Hall. Palo Alto, California: Annual Reviews, Inc. & American Physiological Society, 1948. xi + 552 pages. 23 x 16 cm. \$6

(i) Physical properties of protoplasm; (ii) physiological aspects of genetics; (iii) developmental physiology; (iv) physiology of reproduction; (v) conduction and synaptic transmissions in the nervous system; (vi) osmotic functions of the central nervous system; (vii) vision; (viii) digestive system; (ix) blood cytology; (x) heart; (xi) peripheral circulation; (xii) metabolic aspects of shock; (xiii) respiration; (xiv) anoxia in aviation; (xv) regulation of energy exchange; (xvi) metabolic functions of the endocrine glands; (xvii) heat and cold; (xviii) physiology of sweating; (xix) pharmacology; (xx) the coagulation of blood; (xxi) hemostasis; (xxii) physiological psychology; (xxiii) physiological effects of radiant energy. Author index. Subject index.

[1316] **Nineteenth Annual Report, 1947**

Royal College of Obstetricians and Gynaecologists. London: Royal College of Obstetricians and Gynaecologists [1948]. 207 pages. 21 x 14 cm.

[1318] **Children Act, 1948. 11 & 12 Geo. 6. Ch. 43**

London: His Majesty's Stationery Office [1948]. iii + 56 pages. 24 x 15 cm. 1s. [£0.05]

Part I. Duty of local authorities to assume care of children. Part II. Treatment of children in care of local authorities. Part III. Contributions towards maintenance of children. Part IV. Voluntary homes and voluntary organisations. Part V. Child life protection. Part VI. Administrative and financial provisions. Part VII. Miscellaneous and general.

[1322] **Report of the Governing Body, 1948**

The Lister Institute of Preventive Medicine. London: The Lister Institute of Preventive Medicine, 1948. 12 pages. 25 x 19 cm.

[1326] **The Legacy of Swift. A Bi-Centenary Record of St. Patrick's Hospital, Dublin**

Dublin, St. Patrick's Hospital. Dublin: At the Sign of the Three Candles, 1948. xii + 70 pages; 10 plates. 25 x 17 cm. 5s. [£0.25]

(i) The Hospital in the twentieth century; (ii) the vision of Jonathan Swift; (iii) Swift's heirs; (iv) St. Patrick's Hospital, 1746-1899; (v) the buildings; (vi) officers of St. Patrick's Hospital, 1746-1948; (vii) short catalogue of the exhibition.

[1327] **Medicine and Science in Postage Stamps**

W. J. Bishop & N. M. Matheson. London: Harvey & Blythe Ltd. (Distributors: H. K. Lewis & Co. Ltd.) 1948. 82 pages; illustrations. 18 x 12 cm. 7s. 6d. [£0.375]

(i) Medicine and science in postage stamps; (ii) medical portrait stamps; (iii) trunks from medicine; (iv) scientists; (v) philately of the Red Cross; (vi) tuberculosis stamps; (vii) maternity and child welfare; (viii) hospitals and other medical institutions; (ix) medical symbolism; (x) other stamps of medical interest. Bibliography. A catalogue of medical and scientific portrait stamps.

[1328] **The Case of Augustus d'Esté**

Douglas Firth. London: Cambridge University Press, 1948. 58 pages; illustrations. 19 x 13 cm. 6s. [£0.3]

Part I: The infancy and adolescence of Augustus d'Esté. Part II: The case of Augustus d'Esté. Facsimiles of the manuscripts. Genealogical table.

[1329] **Le Papyrus Médical Chester Beatty**

Frans Jonckheere. Brussels: Édition de la Fondation Égyptologique Reine Élisabeth, 1947. (La Médecine Égyptienne No. 2.) 79 pages; 1 plate. 24 x 18 cm.

(i) Les affections de l'anus; (ii) le traitement des affections anales.

[1330] **Encyclopedia of Medical Sources**

Emerson Crosby Kelly. Baltimore: The Williams & Wilkins Co., 1948. v + 476 pages. 23 x 16 cm. \$7.50

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## Shorter Notices

### Bronconeumonectasias Congénitas. Quistes Aéreos y Ampollas Gigantes de Enfisema

Oscar P. Aguilar & Juan Queirel. Buenos Aires : Editorial Vazquez, 1948. 206 pages; 78 figures. 26 x 17 cm.

These authors reported their first observations on cases of cystic disease of the lungs in articles in the medical press. However, they considered that this subject merited further treatment, and have therefore written the present monograph of 206 pages "in order to bridge the gap which exists in textbooks of pulmonary pathology, in data concerning cystic formations of the lungs, especially giant cysts." The book is also intended as a guide in the differential diagnosis of spontaneous pneumothorax, large cysts and intrapulmonary air cavities of any etiology.

At the end of the 15 chapters into which the book is divided, the writers, who are respectively associate professor of the clinical and pathological study of tuberculosis, Faculty of Medicine, Buenos Aires, and director of a municipal dispensary of chest diseases, give a full report of 19 cases. These are illustrated with 78 figures, consisting of microphotographs, line drawings and radiographs, carefully analyzed and explained.

There is also a short list of references to works by Argentine authors and a separate one of foreign references; the book is well printed.

M. V. L.

### L'Aphasie et la Désintégration Fonctionnelle du Langage

Th. Majouane & P. Mozziconacci. Paris : L'Expression Scientifique Française [no date]. (Symposiums et Monographies de la Semaine de Chéniaux) 156 pages; 19 figures. 21 x 13 cm. 450 fr.

Professor Majouane is professor of diseases of the nervous system at the Paris Faculty of Medicine and physician at the Salpêtrière, while his co-author is a senior physician to the Paris hospitals. In this little book they have concentrated on the functional aspect of speech defects. They trace the history of the various theories of aphasia, and acknowledge their indebtedness, in particular, to the ideas of John Hughlings Jackson. They then describe the basic principles of an objective symptomatology of aphasia which they have evolved, and this in turn leads to the definition of two syndromes, the "syndrome of phonetic disintegration", concerned with defective verbal expression, and the "syndrome of automatic-voluntary dissociation", concerned with the abolition of voluntary verbal stimuli while the spontaneous verbal stimuli remain intact. There follows a chapter on the intellectual condition of aphasic subjects, in which a number of intelligence tests are described and illustrated, and another on the relationship of aphasia to agnosia and apraxia. Finally, the whole book leads up to a discussion of the problem of re-education. Full descriptions of five cases of aphasia and two of agnosia are given as an appendix.

A useful feature of the book is a short summary at the end of each chapter. There is no bibliography but a few books and articles on the history of the subject are suggested for further reading.

A. H.-S.

### Psychotherapy : its Uses and Limitations

D. Rhodes Allison & R. G. Gardon. London : Geoffrey Cumberlege, Oxford University Press, 1948. vii + 160 pages. 19 x 13 cm. 8s. 6d. [£0.425]

This book makes a well-timed arrival into the medical world. Psychotherapy is almost a medical household word, yet its proper role, scope, and limitations are by no means commonly known.

Modest in its claims, this publication seeks merely to indicate the types of cases in which medical practitioners may expect help from a specialist in this form of treatment. Among other things, it deals with the development of psychotherapy and its place in the treatment of psychoneuroses, temperamental instability, psychosomatic conditions, visceral neuroses, the relation of rheumatism to mental illness, the endocrine background, the psychological aspect of organic diseases, and the patient's reaction to bodily disease.

Passing reference is made to the use of group therapy, a form of treatment about which it is too early to deliver full judgement; it is likely that in a future edition a fuller account of this method would be included. At the moment it promises to be an excellent form of social rehabilitation for psychoneurotic patients. In addition, many problems arise in group discussion which are suitably dealt with by the group as a whole and it provides also a method of learning and teaching psychotherapy. Its use in the opinion of many is, however, as a supplement to, and not a substitute for, individual therapy.

This is an excellent book and one has no hesitation in recommending that it should be widely read.

### Remedial Exercises for Certain Diseases of the Heart and Lungs

Hester S. Angove. Second edition. London : Faber & Faber Ltd., 1948. 181 pages; 23 figures. 19 x 11 cm. 10s. 6d. [£0.525]

The authoress deals concisely with those heart and lung conditions and diseases of the blood vessels and veins which benefit from remedial exercises. The last chapter and an appendix are concerned with rehabilitation and chemotherapy. Experience at Guy's Hospital forms the basis for the treatments. When the book is reprinted it might be well worth utilizing the blank space on page 55 for some reference to surgery in congenital heart disease as no mention is made of this type of treatment.

Miss Angove's book should command the attention of all masseurs and massage students who are not familiar with it already, but nurses will be interested in her short, clear descriptions of the conditions treated. The book is not intended for doctors or medical students, but it can show them how much may be done by masseurs to shorten the convalescence of "many suffering from heart complication" and to "give relief to many of those lung conditions which in the past became chronic or ended in death."

F. T.

### Science and Nutrition

A. L. Sacharach. Third edition. London : Watts & Co., 1947. xii + 142 pages. 19 x 13 cm. 6s. [£0.3]

This is the 3rd edition of a little book published first in 1938. The author, who is a chemist of long experience in nutrition, surveys briefly the early experimental work on which our modern science of nutrition is based, and by means of which the importance of dietary deficiencies, qualitative rather than quantitative, could be recognized.

Section II is a résumé of the physiology of human nutrition, the chemistry of the major food constituents, carbohydrates, proteins, fats; their occurrence, and metabolism in the body. Section III deals with mineral elements in foods; Section IV with the vitamins, their detection, measurement, identification, and with the main manifestations of their deficiency in diet. Section V discusses the optimum diet necessary for the maintenance of human health and well-being and shows how much remains to be done in the practical application of scientific knowledge.

The introduction to the 2nd edition (1945), which is included in this edition, pays tribute to the policy of the Ministry of Food in Great Britain during the war years in placing rationing on a scientific basis. In this book the author attempts to explain to the layman the reasons for this basis.

D. F. A.

### Enuresis or Bed-Wetting.

R. J. Batty. Second edition. London : Staples Press Ltd., 1948. 103 pages; 9 figures. 19 x 12 cm. 9s. 6d. [£0.475]

Bed-wetting in infants and children has been a source of worry to parents throughout the ages, and its treatment is mentioned in the writings of Hippocrates and Galen. It is a difficult problem, which has to be faced not only by the general practitioner but also by the staff of every large boarding-school or other institution accommodating children. Much has been written about it, as the bibliography appended to this little book shows, but no monograph in English devoted solely to the subject was available until 1933, when the 1st edition of Dr. Batty's book appeared. In the 2nd edition, which includes chapters on the anatomy and physiology of the urinary organs; the causes, clinical features, and treatment of enuresis; and the enuresis clinic, more space has been devoted to the psychological side of the problem, and some newer remedies are included to replace others which were formerly recommended but which are no longer obtainable. The child who does not respond to treatment and whose enuresis persists into adolescence presents a particularly difficult problem, which is also dealt with in the book. As assistant medical officer to the Lancashire County Council, Dr. Batty has treated nearly 1,000 cases of enuresis, and his book is a valuable contribution towards the alleviation of a condition which has caused so much unhappiness among children and adolescents.

L. T. M.

### A Pocket Medicine

G. E. Beaumont. Second edition. London : J. & A. Churchill Ltd., 1948. viii + 208 pages. 19 x 12 cm. 9s. [£0.45]

Medical students studying for "finals" and doctors abroad who take only light luggage have already found this work a boon while "waiting and travelling". A table of some normal findings, included for the first time, is valuable for reference as it is not always easy to find "normals" quickly. The whole volume has been carefully revised or re-written and new treatments indicated where necessary. Thus radio-active phosphorus has its place, and streptomycin is dealt with in the sections on pulmonary tuberculosis and tuberculous meningitis. The index is an excellent one, and essential because the subjects are arranged under "systems", but Ghon's focus (p. 41) would be a useful addition.

F. T.

### Injertos de Piel

Alberto Raul Beaux. Buenos Aires : Editorial "El Ateneo", 1947. 257 pages; 138 figures. 27 x 18 cm.

It is well known that the war brought about important advances in the field of plastic surgery in those countries particularly afflicted by its consequences, owing to the urgent necessity of repairing large burns and gaping wounds which could be successfully treated only by means of skin grafting.

However, in countries where these needs never arose, there is an increased interest in all modern techniques of plastic surgery—"aesthetic" surgery, as it is called in certain Spanish-speaking countries, expressing its aim rather more precisely, especially from the point of view of the patient. Aesthetic surgery helps him not only to recover his former normal appearance, healing the lesion at the same time, but restores confidence lost through the accident. There are also a certain number of congenital abnormalities which will, in the future, benefit from early surgical intervention, a brighter future for the patient thus being made possible.

Doctor Alberto Raul Beaux gives an account of his own experiences, both at the Institute of Physiology, Buenos Aires, when it was directed by the eminent Professor Houssay, and later on at several other departments of the National University. The author reviews fully, with commentaries and illustrations, the different techniques of grafting in current use abroad.

This commendable book is well produced and edited, with a good list of references and an index of subjects. The paper used is excellent and the type clear; there are a large number of figures and diagrams and two colour plates.

M. V. L.

### Recent Advances in Obstetrics and Gynaecology

Alec W. Bourne & Leslie H. Williams. Seventh edition. London: J. & A. Churchill Ltd., 1948. viii + 326 pages; 85 illustrations. 21 x 13 cm. £1 1s. [£1.05]

A new edition of this famous book is always opened with the keenest interest by all obstetricians. The authors have been determined that their *Recent Advances* is not to degenerate into a small textbook but is to remain a guide to the best in modern trends.

The choice of the new subject-matter in the obstetrical section of the book has been wise. The chapter on nutrition remains as a unique contribution to obstetrical literature. The new chapter on water metabolism in pregnancy gently leads the reader along a path devoid of unpleasant mathematical stones or physiological thorns to bring him finally to the unexplored ocean of toxic oedema! The peremptory order to treat oedematous patients by increasing their fluid intake is one which many will obey with reluctance. We welcome the new section on the anaemias of pregnancy, and the fact that Professor L. J. Davis has written it is sufficient to recommend it to obstetricians who have been familiar with his work on haemoglobin and pregnancy.

We mourn the omission of Wilfred Shaw's chapter on ovarian tumours from the section on gynaecology. Perhaps in a future edition it will reappear, triumphantly bearing an account of some ovarian tumour which shall have superseded the gynandroblastomata as the darling of the gynaecological pathologist. We are all most grateful for the sane and reasoned account of the treatment of carcinoma of the cervix. Without its sustaining effects there would be many unhappy, bewildered candidates for the Membership of the Royal College of Obstetricians. One had hoped that the time had come for an appraisal of the value of the vaginal smear in cancer diagnosis, but that was not to be. It was obvious that the sex hormones had outgrown their home and that subject is now fully dealt with in another volume of the series, *Recent advances in sex and reproductive*

*physiology*, by J. M. Robson. The admirable account of the fascial sling operations is one which should be read by all contemplating performing this type of operation. The reviewer can add his quota to the brilliant successes obtained by these operations but would also add incisional herniae to the list of complications. Our authors are well served by their radiological colleagues, Dr. Rohan Williams and Dr. Levitt, in their respective contributions.

Bourne & Williams have written this edition of their *Recent Advances* with care and dignity, as befits their position of authority. Their unflagging interest and enthusiasm is evident and their book should stimulate their lesser brethren to pause and ponder over many things.

Robert J. Kellar

### A Text-Book of Pathology: an Introduction to Medicine

William Boyd. Fifth edition. London: Henry Kimpton, 1947. 1049 pages; 500 illustrations; 30 coloured plates. 24 x 15 cm. £2 8s. [£2.4]

When this work first appeared in 1932 a reviewer in the *Lancet* wrote "The first reaction aroused by a new production is a guess as to its fate in competition with its established rivals. We predict that Professor Boyd's textbook will enjoy a considerable degree of popularity." Evidently the writer had the gift of prophecy, for some of those "established rivals" have now fallen into the limbo of "out-of-print" books while Professor Boyd's work continues to be in great demand.

It is addressed primarily to students, so the account of all the more important diseases is prefaced by a brief summary of the clinical symptoms to which they are related, and the whole presented in such a readable manner that one suspects that this readability is one of the secrets of the book's success. No fundamental changes have been made in the present edition, but the whole work has been brought up to date, and new references incorporated in the lists at the end of each chapter. New sections have been added on a variety of subjects, including the lipotropic factors in relation to liver diseases; and the part played by Vitamin C in wound repair is discussed. A rare condition in man, botryomycosis, appears for the first time, and old readers will welcome back the useful section on allergy, now entirely rewritten. Recent advances have necessitated such additions as folic acid in relation to macrocytic anaemia, and the rewriting of such sections as those on the Rh factor, and carcinogenesis in its relation to enzymes and viruses.

The book has sometimes been criticized on the ground that it contains "errors", a criticism that the author has apparently tried to meet, for he states in the preface that the "more glaring errors" have been corrected.

F. T.

### Ways to Better Hearing. A Practical Guide for Anyone with Defective Ears

Lowell Brentano. London: George Allen & Unwin Ltd., 1948. 212 pages; illustrations. 22 x 14 cm. 10s. 6d. [£0.525]

Written by an American, who is a "deafened" man, this book is intended primarily for those similarly handicapped, but it can also be recommended to doctors, teachers and welfare workers, who are, by the nature of their work, brought into contact with the deaf. In Part I the author shows how the obstacles to a full private and working life can be surmounted, and in Part II he gives useful chapters, accompanied by exercises, on lip reading, educating the hearing and improving the speech. There are

appendices contributed by American authorities, and one giving a list of approved British dealers in hearing aids. In the introduction, A. G. Wells briefly describes the work of the voluntary bodies in Great Britain, and quotes the relevant sections of the Disabled Persons (Employment) Act, 1944. This adds considerably to the value of the work for British readers, although it is still too early to delineate the role of voluntary and official organizations in the National Health Service.

H.M.C.

### Sizes of X-Ray Film and Intensifying Screens: British Standard 1443: 1948

British Standards Institution. London: British Standards Institution. 8 pages. 22 x 14 cm. 2s. [£0.1]

This British Standard was prepared by the Photographic Industry Standards Committee; it prescribes the sizes of x-ray sheet film and intensifying screens, and specifies the minimum internal sizes for cassettes intended to receive such films and screens. These standards are intended to serve as a basis for the standardization of features of x-ray equipment and of processing equipment.

D. F.

### The Distressed Mind: an Outline of Psychiatry

J. A. C. Brown. Second edition. London: Watts & Co., 1949. (The Thinker's Library, No. 115.) viii + 174 pages. 17 x 11 cm. 2s. 6d. [£0.125]

Writing in simple, lucid language, the author of *The distressed mind* has provided for the general reader a brief and interesting account of many aspects of psychology and psychiatry.

Starting on a historical basis, he describes the dawning of man's interest in mental activity, which eventually developed into the practice of psychiatry. A chapter on the nervous system is followed by an account of psychosomatic problems and a relatively large section of the book contains a useful analysis of the basic concepts of Freud, Adler and Jung.

S. S.

### British Surgical Practice. Volumes 2, 3, 4

Under the general editorship of Ernest Rock Carling & J. Paterson Ross. London: Butterworth & Co. Ltd., 1948. Vol. 2: xxvii + 540 + 35 pages; 318 illustrations; 4 coloured plates. 25 x 17 cm. Vol. 3: xxvi + 524 + 37 pages; 287 illustrations; 4 coloured plates. 25 x 17 cm. Vol. 4: xxvii + 436 + 32 pages; 261 illustrations; 2 coloured plates. 25 x 17 cm. £3 per volume.

Vols. 2 and 3 of this exhaustive survey of surgical practice deal alphabetically with subjects from "Backache to Bursae" and "Caesarean Section to Eyelids." More than ninety experts have contributed sections to these two volumes, each section being fully documented and profusely illustrated (there are more than 600 illustrations in the two volumes). The work maintains the superlative standard of production associated with Butterworth publications, with well-chosen and carefully reproduced illustrations and an excellent lay-out. One small criticism may be made regarding the summary of contents at the head of each chapter; this seems over-elaborate in including every subheading used, which, on consultation of the text, may sometimes prove to concern only two or three lines. In the

[For review of Vol. 5 of this series, see Book Reviews, page 116.—Ed.]

chapter on deformities this summary occupies 2½ pages, much of which might have been used for more text, for there is an exhaustive index to each volume. Similarly the list and description of contributors is lavishly set out; in Vol. 3, 12 pages are used to deal with 63 contributors. These are, however, minor criticisms of a work which, like its older brother the *British encyclopaedia of medical practice*, is sure to take a permanent place in medical literature.

The fourth volume of this imposing collective work covers alphabetically the subjects "Facial Palsy to Hiccup". With so many authoritative articles compressed into one volume it is not possible to mention more than a few of the individual contributions, but particularly notable is that dealing with facio-maxillary injuries and deformities by Rainsford Mowlem and B. W. Fickling, which occupies 42 well-illustrated pages. A careful account of the foot by T. T. Stamm precedes a full discussion of fractures and allied conditions by F. W. Holdsworth. J. B. Oldham contributes a useful account of surgical conditions involving the gall-bladder and bile ducts. C. G. Rob provides a chapter on gunshot wounds, based on personal experience in the 1939-45 war. There is a well-illustrated account of hand injuries by J. N. Barron, while the chapter on diaphragmatic hernia is particularly authoritative, coming from Sir Thomas Dunhill, who has made a particular study of this condition for a number of years.

This volume maintains the high standard of production of preceding volumes in the series.

L. T. M.

### Social History of the School Meals Service

F. Le Gros Clark. London: National Council of Social Service, 1948. 28 pages; illustrations. 21 x 14 cm. 2s. [£0.1]

Two benefits to the schoolchild arising from the institution of a school meals service have been the undeniable improvement in diet and the instruction in a higher standard of behaviour at table, and this booklet, published under the auspices of the London Council of Social Service, stresses the important part that social conditions can play in this particular aspect of school welfare.

The history of the service is traced from its early beginnings, when private charity provided free meals in some schools. Appointment of committees by the London School Board in 1894 to investigate dietary deficiency in children resulted in authoritative action with regard to a school meals service. Legislation provided the means by which this service could be maintained, and by 1930 more and more children were drinking milk in schools.

Complexities of organization were inevitably increased with the outbreak of the war in 1939, owing to the wholesale evacuation from large towns of Britain's schoolchild population, and to the air-raid disruption of transport facilities. However, in 1945, the emergence of the school dining-hall and kitchen as a self-contained unit became apparent, and the author feels that this trend is likely to continue for a while.

The school meals service is so closely tied up with our changing economic system that future social legislation may affect its development; at any rate, it has become an integral part of the present educational system.

S. S.

### Practical Section Cutting and Staining

E. C. Clayden. London: J. & A. Churchill Ltd., 1948. vii + 129 pages; 21 figures. 21 x 14 cm. 9s. [£0.45]

Within the compass of this small book much valuable information is contained, valuable to the trainee who is in the process of acquiring a knowledge of histological technique but no less valuable, as a book of reference, to the trained technician.

The general plan of the book is good, the subject being introduced by reference to the principles of fixation and fixatives. Practical advice on the use of certain of the commoner fixatives, with comments on their advantages and disadvantages, should help the young technician to make a rapid appreciation of the relative merits of each and the tissues best suited to their use. Quite naturally the major portion of the book is devoted to the preparation of paraffin sections and the stains applied to them. The author, while including the usual routine stains, shows rare discrimination in the choice of staining procedures for specific purposes. The section on the care of microtome knives should be of great practical usefulness.

Although less expensive, the chapters dealing with the making of frozen sections and celloidin sections are adequate, and the practical help given the student should prove most useful. Here, too, the author shows commendable judgement in the selection of the staining methods detailed. With so many procedures to choose from, a nicely balanced selection has been made to cover the simple routine stains and the more intricate techniques employed in neuro-histology.

This valuable addition to the library of the histology worker has been written by a practical technician who is obviously a master of his craft and who, in addition, possesses the art of expressing himself briefly but clearly. Throughout the book there are many examples of the author's desire to give the student technician the utmost help by detailing what certain terms really mean, and thus greatly assisting towards a complete understanding of the subject. The preparation of good sections is an art which can be acquired only by diligent study and much practice, and this book goes a long way towards helping the laboratory worker to avoid or overcome many of the difficulties encountered in the cutting and staining of sections.

D. B. S.

### Dietetics in General Practice

Leslie Cole. Second edition. London: Staples Press Ltd., 1948. x + 160 pages. 16 x 10 cm. 8s. 6d. [£0.425]

This is the 2nd edition of a book which could have been made of great value; however, it does not appear to have been completely re-written since first published in 1938. A number of items of food appear which are not now readily available; for example, a distinction is made between red and white meat. The account of the vitamins is far from up to date; thus no mention is made of the difference in nutritional value between vitamin A and its precursor, carotene. The dietary treatment for a number of diseases is described, but in view of the above remarks it will be seen that the book is mainly of use in indicating the general principles involved. These principles are clearly stated. It is to be hoped the next edition will be completely revised, as a pocket volume on medical dietetics suitable for general practitioners is much needed.

Robert Cook

### Blindness in British African and Middle East Territories

Colonial Office. London: His Majesty's Stationery Office, 1948. xii + 99 pages. 24 x 15 cm. 2s. [£0.1]

This is a report of a Joint Committee appointed by the Colonial Office and the National Institute for the Blind, following a visit of a delegation to Africa

and certain Middle East territories between July 1946 and March 1947. It comprises a survey on the statistics of blindness, the causation, the social conditions, the present medical services, education and training facilities, in the areas visited. Certain recommendations are put forward for the prevention of blindness and for the education, training and employment of the young blind. For the older adults and aged possible voluntary enterprises are suggested.

M. M. T.

### Textbook of Medicine by Various Authors

Edited by John Conybeare. Ninth edition. Edinburgh: E. & S. Livingstone Ltd., 1949. xvi + 875 pages; 28 figures; 31 x-ray plates. 24 x 17 cm. £1 10s. [£1.5]

This work was first published in 1929, and now appears in its 9th edition under the same editor, Sir John Conybeare, Physician to Guy's Hospital, London, and with almost the same team of experts as authors. It is in a new format, but the general character and scope of the book remain unaltered. Much new material has been incorporated in the text since the last edition in 1946, and some parts, such as the sections on haematemesis, carcinoma of the stomach, and cardiovascular diseases, amongst others, have been rewritten. Professor R. W. B. Ellis is now responsible for the section on diseases of infants. The book is well produced and senior students will find it an excellent textbook now as they have done in the past.

M. M. T.

### Diseases of the Chest: Described for Students and Practitioners

Robert Coope. Second edition. Edinburgh: E. & S. Livingstone Ltd., 1948. xv + 541 pages; 134 figures; 34 x-ray plates. 22 x 14 cm. £1 5s. [£1.25]

Those students who want a book on chest diseases which will tell how to elicit the main physical signs in the chest will find that this volume meets their needs. It is not intended to be an exhaustive textbook, but a selective one, and, judging from the demand for it, one of the most successful in its field. X-rays are not neglected, and the coloured plates showing microscopic appearances have been more carefully printed than is sometimes possible today.

In this new edition Dr. Coope has taken into account the recent work of Mr. R. C. Brock and others on the anatomy of the bronchial tree, and does not despise footnotes and an occasional reference. These are instructive and stimulating (if sometimes unusual, as when he quotes Chevalier's novel *Clochemerle*), but such quotations serve to garnish an eminently readable book.

F. T.

### L'Exploration Fonctionnelle des Reins, dans la Pratique Médicale

Jules Cottet. Paris: L'Expansion Scientifique Française, 1948. 207 pages. 18 x 14 cm. 400 fr.

This small volume gives a detailed description of the various tests of value in the clinical assessment of renal function and the indications for the choice of the most suitable. There is a preliminary chapter which deals with the physiology and pathology of renal function, and a final chapter criticizing and comparing the value of the various available tests. The detailed instructions concerning their clinical use will be a valuable source of information to clinicians. In discussing the discrepancies of these tests, the author concludes "que, dans l'état actuel

de nos connaissances, il n'y a pas, en matière d'exploration fonctionnelle des reins, une épreuve type, qui serve de pierre de touche pour contrôler la valeur des autres épreuves. Le seul critère... nous semble être la clinique qui, ici comme ailleurs, juge en dernier ressort."

D. F.

### The Biological Standardisation of the Vitamins

Katherine H. Coward. Second edition. London: Baillière, Tindall & Cox, 1947. vii + 224 pages; 38 figures. 22 x 14 cm. 16s. [£0.8]

The author of this monograph is Reader in Biochemistry in the University of London and Head of the Nutrition Department of the Pharmaceutical Society of Great Britain. She has written it for the use of workers engaged in the determination of vitamin content of foods, of preparations for therapeutic purposes and of products obtained in research into the chemical nature of the vitamins. The book is divided into two parts, Part I dealing with the general principles and methods used in the determination of the vitamins, and Part II with the mathematical side of the subject, that is, the estimation of the accuracy of the results of experiments. The adoption of the international standard of reference for vitamin E, and the introduction of methods of estimating fiducial limits of error, are among the many new developments since the 1st edition.

H. M. C.

### Pregnancy Diagnosis Tests: a Review

Alfred T. Cowie. Aberystwyth: Commonwealth Agricultural Bureaux, 1948. (Joint Publication No. 13.) 284 pages. 22 x 15 cm. 15s. [£0.75]

This book is No. 13 of the Commonwealth Agricultural Bureaux joint publications, and is a survey of all the important papers on the methods of diagnosis of pregnancy in women and domestic animals, except those concerned with the clinical methods in women. The author, who held a research grant from the Agricultural Research Council at the National Institute for Research in Dairying, Shinfield, Reading, has produced a useful comprehensive review and extensive bibliography of widely scattered literature, suitable especially for research workers in this subject.

M. M. T.

### Psychological Medicine. A Short Introduction to Psychiatry, with an Appendix on Psychiatry Associated with War Conditions

Desmond Curran & Eric Guttmann. Third edition. Edinburgh: E. & S. Livingstone Ltd., 1949. viii + 252 pages; 20 figures. 22 x 14 cm. 12s. 6d. [£0.625]

This introduction to psychiatry now appears in its 3rd edition, after revision by Dr. Curran alone, as his distinguished collaborator unfortunately died in 1948, while still at the height of his powers. The book's popularity may be gauged by the fact that both previous editions had to be reprinted soon after publication. The work forms a well-balanced introduction to a branch of medicine hitherto relatively neglected by the average medical man. The style is straightforward, readable and convincing, and is lightened here and there by a flash of wit or by the apt citation of an actual case. There is a valuable chapter on psychiatry associated with Service conditions on which Dr. Curran is well qualified to write, in view of his experience as

Consultant to the Royal Navy. For those who desire to study further, there is a carefully selected bibliography, including books on psychopathology and psychotherapy, subjects which in a book of this nature the authors could describe only on a restricted scale.

A. Spencer Paterson

### Chirurgie de la Surdit   (l'Op  ration de Lempert)

J. Salomon Danic. Paris: L'Expansion Scientifique Fran  aise, 1948. 112 pages; 11 figures. 21 x 13 cm. 250 fr.

The advances achieved in recent years in the surgery of deafness have given rise, among the uninitiated or insufficiently experienced, to false hopes and consequent disappointment and loss of confidence. The present work, therefore, by the assistant otolaryngologist to the H  pital Saint-Antoine, Paris, fulfils a need, in that it presents, clearly and without prejudice, the possibilities, difficulties and limitations of Lempert's fenestration operation for otosclerosis. The author emphasizes the delicacy of the operation and the need for extreme technical skill. After tracing the indications for, and the principles of, this particular type of surgery, he describes in detail the technique, after-effects and possible complications of the operation. He describes the results achieved, and compares them with those obtained by means of hearing aids. Finally, the prognosis of the operation is discussed and the author's general conclusions are summarized.

There is a bibliography of some 40 references. The sections on the principles and technique of the operation are illustrated by diagrammatic drawings and the audiograms of patients are also given. The quality of paper is good and the standard of printing high.

A. H.-S.

### The Practice of Industrial Medicine

T. A. Lloyd Davies. With a chapter on the hazards of coal mining by G. F. Keatinge. London: J. & A. Churchill Ltd., 1948. vii + 244 pages; 8 diagrams. 23 x 14 cm. 15s. [£0.75]

This book presents a good description of industrial medicine as practised by a progressive industrial medical officer. It is eminently suited for students of medicine and practitioners seeking to gain an acquaintance with this kind of work; but it will also prove useful and stimulating to experienced clinicians in other fields, affording as it does an insight into the problems of industrial medicine. The book is by no means comprehensive, but does succeed in dealing with essentials and in presenting much valuable material in little space. The presentation is coloured by the author's enthusiasm and material which might otherwise have been rather dull is made unusually readable.

The relationship between work and social conditions is well expressed; the book has been written from the point of view of the clinician rather than the hygienist, but is none the less valuable on that account. There are a few minor errors, mostly typographical, which can be easily rectified and do not detract seriously from the general value of the book. It is, of course, difficult to write with any permanence about the administrative side of work on this or any other facet of health services at the present time; there will be need for early revision in the light of new legislation.

T. F.

### Diphtheria. Report by the Infectious Diseases, Sub-Committee of the Scientific Advisory Committee

Department of Health for Scotland. Edinburgh: His Majesty's Stationery Office, 1948. 31 pages. 24 x 15 cm. 6d. [£0.025]

This report embodies the results of a study undertaken by the Sub-Committee on Infectious Diseases Research of the Department of Health for Scotland. In 1940, this Sub-Committee recommended that diphtheria immunization should be applied as a national measure in Scotland; it was consequently desirable to gain exact information on the way in which inoculation modifies the clinical course of diphtheria, admitting that it does not always prevent its occurrence. Data were gathered from 17 infectious diseases hospitals in Glasgow, Dundee, Aberdeen and Lanarkshire; the salient features of all cases accepted as suffering from diphtheria during 1942 were collected and submitted to extensive statistical analysis.

The study of 1023 inoculated and 3249 uninoculated patients showed that inoculation significantly modifies the course of the disease. The fatality rate of the inoculated group was 0.68 per cent (7 deaths) as against 3.69 per cent (120 deaths) in the uninoculated. In general, the complications and severity of the disease were less in the inoculated group.

D. F.

### An Introduction to the Prescribing and Fitting of Contact Lenses

Frank Dickinson & K. G. Clifford Hall. London: Hammond, Hammond & Co. Ltd., 1946. 168 pages; 65 plates; 33 figures. 22 x 14 cm. 2s. [£2.1]

This book is distinguished by the competence with which the subject is presented and by the moderation and balance of the claims made for contact lenses. It is probably the best introduction to contact lens fitting and prescribing hitherto published in the field of "spherical", "ground" or "machine-made" lenses, and the account is full and up to date. In the realm of taking moulds and fitting moulded lenses it is, perhaps, less adequate, largely on account of advances made since 1946. For this reason, also, anti-veiling devices are not discussed.

The optics of contact lenses are clearly stated with a minimum of mathematics, and include two valuable nomograms for effectivity and radii, prepared by A. G. Bennett. The text is unusually free from errors and is supported by 93 illustrations, including ten in colour illustrating the fluorescein technique, which are well planned and beautifully prepared and printed.

Frederick Ridley

### O Tratamento Cir  rgico da Hipertens  o do Sistema Porta por Anastomose Venosa Direta

Alvaro Dino de Almeida. S  o Paulo: "Revista dos Tribunais" Ltda., 1948. 261 pages; illustrations. 23 x 16 cm.

381 references to literature in several languages bear witness to the amount of research which forms the basis of this detailed account of the surgical treatment of portal hypertension, by Dr. Alvaro Dino de Almeida of the Department of Surgery in the Faculty of Medicine, S  o Paulo. The author classifies the effects of portal hypertension, with special reference to hepatic cirrhosis, oesophageal varices, ascites and the formation of collateral venous circulation. He analyzes the different methods of surgical treatment and, after a full discussion, concludes that left spleno-renal anastomosis is the best. Porto-caval anastomosis (Eck's fistula) is condemned.

Numerous diagrams, pictures and tables illustrate and explain the author's views, and summaries in English and German are included. From the long list of errata in the text, given on a separate sheet, one may assume that the editing has not been done with the meticulous care due to so painstaking and complete a work.

M. V. L.



### Obstetrics and Gynaecology. A Synoptic Guide to Treatment

Beatrice M. Willmott Dobbie. London: H. K. Lewis & Co. Ltd., 1948. xi + 338 pages; 22 figures. 22 x 14 cm. £1

This book is described on the cover as a "Synoptic Guide to Treatment" and Dr. Dobbie emphasises this in her preface; she has written it for the general practitioner and given a full measure of her experience in both obstetrics and gynaecology.

Her writing is forthright and emphatic with italics, capitals, do's and don'ts. On the whole it is well done even though there are parts where hyperbole is the order of the day. There is much that is useful and the chapters on "Telling the Patient" are especially good. Essentially this is a book based on Dr. Dobbie's own wide experience in practice and on the statistics of the Birmingham Maternity Hospital. A few parts could be improved. Thus, sulphadiazine is chosen for puerperal infection but there is no mention of the need for giving sufficient fluids and alkalis with it. Also puerperal thrombophlebitis is very inadequately discussed. The author commends radiography of the patient as useless unless "the position of the patient is so arranged that the rays are directed vertical to the planes both of the brim and the film" (her italics). This is a serious oversimplification of the whole problem of pelvimetry and cannot pass without challenge. In spite of such shortcomings this should prove a useful book for practitioners.

C. Scott Russell

### Manual of Obstetrics

Thomas Watts Eden & Eardley Holland. Ninth edition by Alan Brows. London: J. & A. Churchill Ltd., 1948. xii + 796 pages; 48 plates; 405 figures. 22 x 15 cm. £2 2s. (£2.1)

The 9th edition of Eden & Holland which reflects the practice of the London Hospital now reappears after eleven years, substantially revised by the Obstetrical and Gynaecological Surgeon of that hospital. The basic principles of obstetrics, recent researches and new methods of diagnosis and treatment are here presented in a simple and readable form. The changes in the text, too many to enumerate fully, include new material on exophthalmic goitre; abnormalities of the embryo and foetus; recent advances in bacteriological diagnosis of puerperal infections; physiotherapy in relation to pregnancy; and the researches of the late Dr. Joseph Barcroft on the development and initiation of pulmonary respiration in the sheep foetus, with their application to the diagnosis and treatment of asphyxia neonatorum.

Nine new coloured plates, 40 x-ray films, and 150 new drawings, charts and diagrams have been added to the text, and there is a "Guide to Further Reading" at the end of each part.

H. M. C.

### Mental Health. A Practical Guide to Disorders of the Mind

John H. Ewen. With a chapter on special treatments and their practical technique, by C. Friedman. London: Edward Arnold & Co., 1947. 270 pages. 22 x 14 cm. 12s. 6d. (£0.625)

This book is a compendium covering the entire field of psychiatry, including psychopathology, administrative and legal aspects. A chapter on physical methods of treatment is contributed by Dr. C. Friedman. In his preface the author appears to imply that his book is meant to serve as an introduction and guide to the subject of mental disorders for workers within the mental health services, and also for doctors beginning

mental hospital work. One wonders whether this purpose might not have been better served by a fuller treatment of fundamentals, while abandoning the attempt of covering the whole ground in an equally detailed, but necessarily dogmatic and conventional manner. The beginner will only be confused by such a concentrated presentation while, with present-day requirements for the Diploma in Psychological Medicine, the postgraduate student needs a much deeper grasp and broader knowledge than is imparted by this short book.

Felix Post

### Otitis Media en el Lactante. Estudio, Fisiopatológico y Clínico

Manuel Fairén. Saragossa: Publicaciones de Revista Española de Pediatría, III, 1947. 382 pages; 126 illustrations. 24 x 17 cm.

In an age of increasing specialization the need for monographs devoted to particular subjects is becoming more and more apparent. Upper respiratory infections are so common and troublesome that the third volume of the publications of *Revista Española de Pediatría* assumes a very real importance to all who are entrusted with the care of young children.

Manuel Fairén's work includes much more than the title might suggest. In a well-balanced account he deals with the development, anatomy, and bacteriology of the middle ear before passing to a consideration of its diseases. There is a very full account of the clinical manifestations. Every possible manner in which otitis media might be encountered in the very young is well described. The illustrations are carefully selected and to the point, the print good, and personal statistics enhance the value of the verbal text. Treatment by surgical and non operative procedures receives attention, while the bibliography forms a notable feature of this useful monograph.

N. M. Matheson

### Pharmacology

J. H. Gaddum. Third edition. London: Geoffrey Cumberlege, Oxford University Press, 1948. xvi + 504 pages; 75 figures. 22 x 14 cm. £1 5s. (£1.25)

The 3rd edition of this excellent textbook of pharmacology has been brought thoroughly up to date and continues to uphold the high standard set by the previous editions. It includes a preface on pharmacological literature which should serve as a useful guide for those who wish to pursue their studies further. The final chapter deals with general pharmacology, and contains important information on rate of absorption and combined effects of drugs, calculation of error, and methods of assay.

The author approaches the study of pharmacology from the physiological view-point, and at the beginning of each chapter describes the experimental methods employed to study the action of drugs on man and on laboratory animals.

It is possibly advantageous in a work of this type to omit details of dosage and individual drug preparations, but the inclusion of the dose of streptomycin and paludrine is inconsistent with the omission of any reference to the doses of the commonly used alkalis, alkaloids and glucosides. The reviewer feels that the inclusion of the dose of one important representative substance in every group of drugs would increase the value of this book. The dosage of sulphonamide preparations is very rightly discussed and the chapter on chemotherapy is one of the best in the book. All the latest sulphonamides receive mention, although nothing is said of the use of sulphonamide mixtures to potentiate action, increase solubility, and diminish toxicity.

The treatment of diabetic coma is discussed along conventional lines, glucose being advised in addition to insulin. Some authorities would consider the dosage of insulin to be too small for patients actually in coma (50-80 units at once, followed by 25-30 units with 25 g. glucose every 2 hours until ketosis disappears). However, it would be unwise to make further comment on this point as the treatment of this condition is now in the melting-pot.

More definite criticism may be made of the recommendation to implant subcutaneously 200 or 400 mg. of desoxycorticosterone acetate in the treatment of Addison's disease. The reviewer has seen hypertension and congestive cardiac failure result from the implantation of 200 mg and believes that 100 mg. is the correct dose. In his experience larger amounts do not increase or prolong the action.

This book should prove invaluable to the medical student in his clinical years and make pleasant and highly instructive reading for all clinicians, to whom the important references included in each chapter should especially appeal.

J. F. Goodwin

### The Queen Charlotte's Text-Book of Obstetrics

G. F. Gibberd et al. Seventh edition. London: J. & A. Churchill Ltd., 1948. xi + 572 pages; 289 figures. 24 x 15 cm. £1 8s. (£1.4)

"Queen Charlotte's" has long been worthy of the famous hospital whose name it bears, and the new edition will not disappoint its readers. An additional chapter gives a clear account of the Rh factor and its connexion with foetal haemolytic disease. Research workers, notably the late Sir Joseph Barcroft, and Barclay and his team, have added considerably to our knowledge of the physiology of the foetus since the last edition of "Queen Charlotte's" appeared in 1943. This work is summarized very well in the second chapter. The section on the baby has been re-written and contains a timely reminder on vaccination. "Recent outbreaks of smallpox in Great Britain mark the need for a more active propagandist attitude on the part of those concerned with the care of the newborn." The chapter on the premature baby, which includes the result of Sandifer's study at the hospital, also reveals that incubators are not used there, but "the simplest technique compatible with safety". It is also interesting to note that no mention is made of thyroid extract for failing lactation despite Dr. Margaret Robinson's results elsewhere.

The new edition has revived the popularity of the book with students and others. Now that the work has been brought up to date its readability, and modest price for its size, should sustain the initial demand.

F. T.

### Estudios sobre la Coca y la Cocaína en el Perú

Carlos Gutiérrez-Noriega & Vicente Zapata Ortiz. Lima: Ministerio de Educación Pública, 1947. 144 pages; 32 figures. 22 x 16 cm.

This book is based on four years' joint research by the authors, who are respectively director and director of research in the Institute of Pharmacology and Therapeutics of the Faculty of Medicine, Lima.

In reviewing the early history of coca addiction (in the form of coca-leaf chewing), the authors accept the view that in the Inca epoch the habit was a privilege of certain classes, but after the Spanish conquest it spread throughout the community—an event which is deplored in many Spanish writings of the period. Then and later, however, coca addiction found more advocates than opponents.

owing to its effects on endurance, and a favourable opinion of it prevailed as late as the early part of the present century.

The chapter on habituation to coca and cocaine contains an interesting account of experimental production of cocaine addiction in dogs, in which the authors state that when a painful electric shock was made the preliminary to a cocaine injection, most of the animals underwent this without compulsion or restraint rather than forego the drug.

Further chapters discuss sensitization to cocaine, its effects on the nervous system and mental activity and the relation of these to social backwardness and delinquency, its effects on metabolism, its action in promoting muscular activity and endurance, and its toxicity. The monograph has an adequate summary in English and a bibliography.

B. M. S.

### Recent Advances in Pathology

Geoffrey Hadfield & Lawrence P. Garrod. Fifth edition. London: J. & A. Churchill Ltd. 1947. viii + 363 pages; 60 illustrations. 21 x 14 cm. £1 ls. [£1.05]

The 5th edition of *Recent advances in pathology* contains only few, nevertheless significant, changes as compared with the preceding one. Perhaps the most important of these is the chapter on nephritis, in which the contributions of Ellis, Evans and Wilson, of the London Hospital, are presented. The twenty years' careful work of this group has cleared up much obscurity and confusion in the classification and understanding of the pathogenesis of nephritis; in importance, their work is justly placed beside that of Volhard and Fahr.

An entirely new chapter outlines the relationship between liver diseases and dietary deficiencies and gives an account of studies on infectious hepatitis. New additions have been made to the chapters on inflammation and on experimental cancer research, the chapter on the latter having also been rearranged.

All the new material presented has been written with the clarity and succinctness well known to the readers of this volume.

G. P.

### Materia Medica, Pharmacy, Pharmacology and Therapeutics

William Hale-White. Twenty-eighth edition, revised by A. H. Douthwaite. London: J. & A. Churchill Ltd., 1949. viii + 532 pages. 19 x 12 cm. 16s. [£0.8]

It is not often that it is possible to record an appreciable decrease in the size of a medical work, but the new edition of "Hale-White" has seventeen fewer pages than its predecessor. This is because many of the older preparations now seldom used, which the authors were sometimes criticized for retaining in the past, can now be excluded because they are no longer in the *British Pharmacopoeia*. As Dr. Douthwaite writes in his preface, "The reader will note with satisfaction the disappearance from official status of many useless preparations..." Changes of name in the new B.P. are also to be found incorporated in "Hale-White".

Many alterations and additions have been made necessary by recent advances. Some are quite small, such as the inclusion of procaine penicillin for the first time; others are more notable. Under streptomycin in the previous edition it is stated: "No cure [of tuberculosis] has yet been obtained by its use in the human being", but in the present edition this has had to be changed to "Many cases of acute tuberculosis in human beings have been cured by its use."

Unfortunately a printer's error in the 27th edition has been carried over into the 28th. In the chapter on digitalis glycosides it is stated that the rectal

dose of tincture of digitalis is less than the oral dose; 0.1 ml. per lb. body wt. in the former and 0.125 ml. per lb. body wt. in the latter case. This would mean a single oral dose of approximately 17 ml to a 140-lb. patient which, although doubtless the maximum safe dose by mouth, could be tolerated without risk if given per rectum.

A useful typographical change has been made. The opportunity of extensive revision has been taken to substitute "G" for "grm." previously used as the abbreviation for gram. Another welcome change is the substitution of milligrams (mg.) for fractions of a gram. Dr. P. M. F. Bishop is again responsible for the revision of the chapter on sex hormones.

"Hale-White" has long been a favourite with students and practitioners because of its wide range and its concise but adequate notes on the various drugs. The use made of heavy type, and the lay-out generally, also facilitates quick reference. This is the first edition since the appearance of the new *British Pharmacopoeia*, and should more than maintain "Hale-White's" popularity.

### Practical Histology for Medical Students

D. T. Harris. Fourth edition. London: H. K. Lewis & Co. Ltd., 1947. 36 pages; 2 plates. 25 x 20 cm. 12s. 6d. [£0.625]

This attractively produced guide to histological methods is written by the Professor of Physiology in the London Hospital Medical School. It sets out very clearly in the form of notes, often numbered with headings in heavy type, details of apparatus and technique, and this form makes it a most useful vade mecum in work at the bench. Elementary essentials are described for the beginner, such as the use of the microscope, the student's private apparatus and laboratory bench, the cleaning of slides and taking of blood samples. Points of interest in the examination of tissues of various parts of the body are briefly indicated and the preparation of stains and tissues is clearly described.

H. M. C.

### A Study of Hospital Administration

Frank Hart & A. J. Waldegrave. London: Franks & Sons Ltd., 1948. ix + 188 pages. 22 x 14 cm. 15s. [£0.75]

This is a study of hospital administration in Britain immediately prior to the changes inaugurated by the National Health Service Act of 1946, which became operative in 1948. It is therefore in some respects already out of date, but it will be a valuable guide to those responsible for changes in the administrative machine. Future progress and improvement must depend to some extent on past experience, of which this book provides a very adequate account. It contains chapters on authorities and committees (of voluntary and public authority hospitals), the administrative background (co-ordination and control; stewards, domestic staff, maintenance, etc.), administrative aspects of the medical and nursing services, patients (admission and general well-being; pay-beds), ancillary services (after-care and records), supply and control of stores, catering, co-operation and co-ordination among hospitals, accounts, costing and statistics, and planning for the future.

L. T. M.

### The Practice of Mental Nursing

May Houlston. Edinburgh: E. & S. Livingstone Ltd., 1947. xi + 164 pages. 19 x 13 cm. 7s. 6d. [£0.375]

Here is a book to place in the hands of the junior mental nurse, for it affords the kind of help she badly

needs; it will help her to get to know all that is expected of her and will aid her to make herself really efficient. The language is clear, the style forthright, and the whole exposition lucid and convincing. Obviously stirred by the recent advances in the treatment of mental illness, the author has sailed into her task with a fine spirit of infectious optimism. The book is very attractively designed and printed; author and publishers alike are to be congratulated for so adequately filling a gap in the literature of mental nursing.

I. M. Sclere

### Short Textbook of Surgery

C. F. W. Illingworth. Fourth edition. London: J. & A. Churchill Ltd., 1947. viii + 680 pages; 227 figures; 12 plates. 24 x 15 cm. £1 10s. [£1.5]

No new edition of this work has appeared since 1942. The present volume therefore contains extensive changes and additions. Penicillin therapy has had to be considered, anti-coagulants, thiouracil, and the Rh factor. Of the completely new sections one notes with satisfaction those on arterial injuries and rehabilitation, and of those that have been re-written the one on burns deserves special mention.

A good book on surgery should be well illustrated, and this has been achieved despite the low price. The illustrations are drawn mainly from cases seen in recent years at the Edinburgh Western Hospital. The author states, "I have endeavoured to mould this book in a form suitable for undergraduate and postgraduate students", and the continuing demand from both classes of reader shows that he has succeeded. It is one of the best surgical textbooks published in one volume, and certainly the most modestly priced.

F. T.

### British Hospitals

A. G. L. Ives. London: Collins, 1948. 50 pages; 26 illustrations; 4 coloured plates. 22 x 16 cm. 5s. [£0.25]

This book, one of the Britain in Pictures series, covers the history of hospitals in Britain from A.D. 600 to the present day, describing the mediaeval period, the monastic foundations, the royal hospitals, the beginning of scientific medicine, the development of voluntary hospitals, anaesthesia, the work of Florence Nightingale, antiseptics, the discovery of x rays, and the application of bacteriology in medicine, besides other landmarks. Mention is made of the outstanding personalities responsible for the development of clinical medicine and teaching. The writer, who is secretary to the King Edward Hospital Fund for London, obviously has an intimate knowledge of his subject and of the literature concerning it. The illustrations interspersed throughout the book have been carefully selected and beautifully reproduced; they complete what must be one of the shortest and best histories of the subject yet produced.

L. T. M.

### Truby King—the Man

May King. London: George Allen & Unwin Ltd., 1948. 355 pages; 15 illustrations. 22 x 14 cm. 18s. [£0.9]

Sir Frederic Truby King, who was born in New Zealand in 1858 and died there in 1938, was internationally recognized as a pioneer in child welfare. His work to promote breast feeding and to lessen the mortality from infantile diarrhoea was so successful that he was encouraged to found institutes in New Zealand for training in his methods, which were soon imitated in most English-speaking countries throughout the world.

Truby King's adopted daughter Mary, who acted as his confidential secretary and assisted him in founding the Truby King Mothercraft Society in Australia, and who is well known for her manual entitled *Mothercraft*, which is based on his methods, has written this full-dress biography. It is well documented and copiously illustrated and will become the standard source of reference to Truby King. Written in a most interesting style, it well repays reading, and will be a source of inspiration to all those who are working for the welfare of the mother and child.

L. T. M.

### The Scotsman's Food. An Historical Introduction to Modern Food Administration

A. H. Kitchin & R. Passmore. Edinburgh: E. & S. Livingstone Ltd., 1949. v + 86 pages; 10 figures. 18 x 12 cm. 3s. 6d. [£0.175]

As a Scot I cannot but feel some disappointment with this little book. For *The Scotsman's food* is, and is admitted to be, no more than "An historical introduction to modern food administration."

The authors, understandably and quite rightly, are more familiar with, and more interested in, the present than the past. Within small compass they have given a fair and scientific presentation of modern problems of nutrition. And tacking their presentation on to the food habits of one nation is an ingenious device to bring home to readers the reality of the problem. But now, having thus cleverly made use of the Scot and his dietetic idiosyncrasies, will the authors not find time, as a relaxation from the present-day problems of nutrition, to expand the introductory section of their book into a scholarly study of food habits in Scotland? It is to be hoped that they will do so.

In the meantime they are to be congratulated on the writing of an interesting and useful primer, and their publisher deserves credit for keeping the price within the thrifty bounds traditionally associated with the Scot.

R. C. Garry

### La Streptomycine et ses Applications Thérapeutiques (Principalement dans la Tuberculose)

C. Levaditi. Paris: Presses Documentaires, 1948. 218 pages; 76 figures. 22 x 14 cm.

We welcome this survey of the history, problems and future possibilities of streptomycin from the pen of an eminent French authority. Professor Levaditi is the scientific director of the Institut Alfred Fournier, and his work on virology, both there and at the Institut Pasteur, where he was formerly a professor, is well known. As he tells us in his preface, he was able to obtain, early in 1946, through the courtesy of Mr. Selman A. Waksman, a small quantity of streptomycin, as well as a culture of *Actinomyces griseus*, from the United States, and with these conducted a series of experiments at his own institute which fully confirmed the American discoveries. The present book, therefore, in addition to reviewing the history and literature of the subject, describes the author's own investigations.

An introductory historical chapter is followed by chapters on the culture media of *Actinomyces griseus* and the factors affecting the elaboration of streptomycin. Next comes an account of the general properties of the latter, its purification, concentration, crystallization and chemical constitution. These chapters are followed by one on the industrial preparation of streptomycin, after which the estimation and range of its antibiotic

activity are described. Next the author studies the pharmacological aspect and the question of tolerance, and this leads to an account of the mode of action of the drug and a chapter on resistance to it. The following chapter, on resorption, circulation, dispersion and elimination, completes the first half of the book. The remaining chapters are devoted to problems of therapy—experimental, in human infections other than tuberculosis, and in human tuberculosis—and tolerance of the drug in human subjects. The therapeutic aspects are treated in great detail; the chapter on experimental therapy is subdivided according to the various types of infection, while the clinical chapters begin with sections on the basic principles of treatment and methods of administration and then consider each infection separately and in detail.

There is a bibliography of 334 references and the figures and tables are numerous and on the whole clear. The research, erudition and care expended on the preparation of the material for this book seem, at least to a British eye, to merit a better and more imposing physical presentation.

A. H.-S.

### Minor Surgery

R. J. McNeill Love. Third edition. London: H. K. Lewis & Co. Ltd., 1948. vii + 430 pages; 221 figures. 18 x 12 cm. £1 2s. 6d. [£1.125]

This popular work, as stated in the preface, is "intended to be a guide to hospital residents, and an aid to practitioners . . . called to deal with minor surgical problems or common surgical emergencies." New matter has expanded the book by 33 pages. Perhaps the most notable of the additions is the section on curare, as there is a need for a short summary of present knowledge, but the section on anaesthetics also includes for the first time the Junker bottle and Shipway's apparatus for the administration of chloroform. Penicillin is adequately covered for a book of this type, as there are two pages devoted to it and 11 entries elsewhere in the text. Sulphonamide therapy has also been brought up to date, and the whole work bears signs of the careful revision inferred in the preface.

If, as is stated on p. 127, "a granny knot should never be used", why print an illustration (fig. 46) showing how the knot is tied? Presumably some people must make granny knots without knowing it.

The new Love's *Minor surgery* should continue to be useful to all who need a clear, attractively printed guide to up-to-date methods in this subject.

F. T.

### Personality Projection in the Drawing of the Human Figure. (A Method of Personality Investigation)

Karen Machover. Springfield, Illinois: Charles C. Thomas, Publisher; Oxford: Blackwell Scientific Publications, Ltd., 1949. ix + 181 pages; illustrations. 22 x 14 cm. 17s. 6d. [£0.875]

This book is an attempt to present Dr. Machover's theory that the drawing of a male and a female figure can be used as a "projective" mechanism; in other words, she assumes that a person's attitudes, complexes, strivings, and so forth, are revealed in the kind of drawing he makes. This view is by no means a new one; the work of Waechner, Altschuler & Hattwick, Elksich, and many others, has already indicated that methods of this type may have a certain degree of validity. More recently still, Buck, in his House-Tree-Person (HTP) Test, has developed a well-articulated technique for analyzing the drawings of a house, a tree, and a person, which he asks his subjects to make.

Dr. Machover's book does nothing to establish the validity of the procedures suggested, nor does it offer any evidence of the reliability of the interpretations attempted. Most of her interpretations are of a type which will hardly stand a critical appraisal. Here, for instance, are the interpretations she makes of the hair style of a drawing: "The hair style is tight and compact (effort at restraint), but essentially fuzzy and very dark in line pressure (impulse to primitive and free sexuality turned into anxious aggression). The hair covers most of the forehead (suggests dependence upon sexual vitality and allure far social appeal rather than upon intellectual attainment)." As no evidence is offered for the validity of this type of interpretation, with the exception of a vague reference to some matching experiments, not described in any detail, it cannot be said that this book adds anything to our methods of assessing personality, but rather marks a reversal to intuitive and subjective ways, which, one had hoped, modern psychology had outgrown.

The book is attractively produced and will, no doubt, appeal to those who dislike a scientific approach to personality.

H. J. Eysenck

### Handbook of Practical Bacteriology. A Guide to Bacteriological Laboratory Work

T. J. Mackie & J. E. McCortney. Eighth edition. Edinburgh: E. & S. Livingstone Ltd., 1948. viii + 624 pages; illustrations. 22 x 14 cm. £1 5s. [£1.25]

The popularity of this book is demonstrated by the fact that no fewer than eight editions have been produced since its first appearance in 1925. It is a fairly comprehensive guide to bacteriological technique. Methods are described for most of the procedures carried out in a routine laboratory. As the methods are chosen with care they work, and as the descriptions are clear and precise they can be readily followed. The present edition has been enlarged and completely revised to bring the book up to date. Much additional information is given, some of which appeared in an appendix in the two wartime editions. The section on the cultivation of micro-organisms has been extended to give details of recently described culture media and that on the testing of antiseptics now includes an account of tests in connexion with sulphonamide and penicillin therapy. The chapter on filtrable viruses has also been considerably enlarged and is now a useful summary of our present knowledge on virus infections.

In order to include so much technical information in a bare 600 pages it has been necessary to prune theoretical considerations to a minimum, thus making the book somewhat lifeless and unsuitable as a textbook for undergraduate students. This, however, is of less importance to the laboratory worker, who will find the book's explicit technical instructions make it invaluable as a laboratory handbook.

Mary Barber

### El Inglés para Médicos y Estudiantes de Medicina. Curso Rápido de Lectura

R. Mackin & A. Weinberger. London: Longmans, Green & Co., 1949. ix + 143 pages. 19 x 13 cm. 7s. 6d. [£0.375]

This useful little book is designed for Spanish-speaking medical practitioners and students who wish to acquire a reading knowledge of English sufficient to give them access to professional literature. It consists of a graduated series of readings, all but the most elementary of which are

from standard English and American medical texts. Each reading is accompanied by a vocabulary and a full commentary on grammar and idioms. A general vocabulary, indexes of idioms, abbreviations, and points of grammar, and a list of weights and measures are useful additions to the work. The readings, chosen with much intelligence, cover a wide range of subjects: nutrition, anatomy, therapeutics, endocrinology, cardiology, the nervous system, general physiology, infectious diseases, serum sickness, diphtheria, circulatory disturbances, influenza, bronchitis, syphilis, nasal obstruction, chemical pathology, appendicitis, leucotomy, ring-worm, and pulmonary tuberculosis. English pronunciation is not discussed; the student with no previous knowledge of English will no doubt supply this omission for himself as a preliminary to the course.

B. M. S.

**The History of State Medicine in England: Being the Fitzpatrick Lectures of the Royal College of Physicians of London for the Years 1946 and 1947**

Arthur Salusbury MacNalty. London: The Royal Institute of Public Health and Hygiene, 1948. 82 pages. 25 x 19 cm. 12s. 6d. [£0.625]

Sir Arthur MacNalty's Presidential Address to the Royal Society of Medicine in 1946 on the evolution of preventive medicine in England is here used as an introduction to four lectures. In these he traces the history of state medicine in England from its beginnings at the accession of Queen Victoria in 1837 to the establishment of the Ministry of Health in 1919.

In the first lecture, the author describes the work of pioneers such as Chadwick, Shaftesbury and Southwood Smith, culminating in the formation of the General Board of Health and the appointment of the first medical officers of health. During this period, there were advances in epidemiological knowledge, and the second lecture outlines the investigations into disease undertaken by the Medical Department of the Privy Council, to which the duties of the General Board of Health were transferred in 1858. The events leading to the appointment of the Royal Commission of 1869-71, and the subsequent passing of the Public Health Act of 1875, are also described. The great advance in public health services under the Medical Department of the Local Government Board is the subject of the third lecture. The discoveries of medicine and bacteriology were applied to public health, and public health authorities played an increasingly important role in preventive medicine. The final lecture describes how in the 20th century, while advances were being made in disease control, the foundations of the national health services were laid: first, in the school medical service, and then in national health insurance, followed by the formation of the Medical Research Committee. Finally, in 1919, the Ministry of Health was established.

The story of eighty years' progress is enlivened by the author's learning in social history and literature; he has added biographical detail and quotations from original reports, which make the lectures fascinating reading. A bibliography is appended to each lecture.

H. M. C.

**Textbook for Almoners**

Dorothy Manchée. London: Baillière, Tindall & Cox, 1947. xii + 466 pages; 7 plates; 49 illustrations. 23 x 15 cm. £1 7s. 6d. [£1.375]

This book has suffered from delays, at present inevitable in Great Britain, in securing paper, and from other production difficulties. As a result, for students now in training or almoners going into practice here, it has serious disadvantages as a textbook, since much of the information is out of date; also a great deal of the information is of use only to those working in the London area.

In spite of this, those in other countries who are interested in the British almoner's methods will find that there are ample descriptions given of the history and development of the almoner's work, and of the immense variety of agencies—voluntary and official—upon which she can call for help in almost every conceivable need. They will find, too, an indication of the student's training and her function when employed, as well as an account of her office routine and of her working relationships with doctor, nurse, administrator, social worker and patient.

There is still more than a trace in this book of the bad old days when the almoner's proper work was hampered by the imposition upon her of the duty of assessing payments by patients. Happily, with the introduction of the National Health Service, that invidious task has now been taken away from British almoners.

The medical information given would have been better omitted. It is out of place and not impeccably accurate.

**Practical Food Inspection. Volume II. Fish, Poultry and other Foods**

C. R. A. Martin. Third edition. London: H. K. Lewis & Co. Ltd., 1948. vii + 284 pages; 59 figures. 22 x 14 cm. 18s. [£0.9]

The emphasis is again on the practical aspect of inspection in this second volume of "Martin", but it is nevertheless a repository of information concerning food. The imagination is captured in the first paragraph by references to the use of submarine detection apparatus and wireless by the fishing fleets, and throughout the book the author goes out of his way to make his subject attractive. For example, a food inspector does not need to know why a "Finnon" baddock is so called, but Mr. Martin enlightens him in his usual interesting fashion.

One would have liked to have read the author's views on dyed smoked fish, but he does not mention a matter which has been a controversial subject for a quarter of a century. The important question of the sewage pollution of shellfish is adequately discussed, and the sterilization of oysters by one of the methods described should be made compulsory. Public health workers will be particularly interested in the chapters on milk and milk products, and food poisoning. Legislation relating to the many subjects covered by the book is summarized, with long extracts, in the last chapter.

A great deal of the information presented should be popular with a wider public if published in a more general work. Many people must wonder how such typical British meat products as tripe and chitterlings are prepared; and how to recognize staleness in fish and other foods is of interest to every housewife.

F. T.

**A Textbook of Surgery for Dental Students**

G. Percival Mills & Humphrey Humphreys. Fifth edition. London: Edward Arnold & Co., 1948. vii + 368 pages. 82 figures. 22 x 14 cm. 18s. [£0.9]

The fact that a 5th edition of this book has been published since the first issue in 1913 speaks well

for its continued popularity. On this occasion it has been prepared by Professor H. Humphreys and Mr. W. G. Mills, F.R.C.S., as Mr. G. P. Mills has retired from practice. In carrying out an extensive revision and bringing the subject-matter up to date the authors have carefully preserved its original character and purpose, primarily those of a textbook for dental students. It is stated in the preface that the text covers the requirements in surgery of those examining bodies publishing a detailed syllabus.

The opening chapters extending over 210 pages are devoted to the fundamental principles of surgery and include a description of surgical bacteriology, inflammation, haemorrhage, surgical infectious diseases, tumours and cysts, fractures and dislocations, injuries and diseases of blood vessels, diseases of bone and the nervous system. An explanation is given of the various terms that are used, a feature which is helpful to the student. This section contains much that is instructive and, as would be expected, a number of conditions that are not usually encountered by the dentist.

The subsequent chapters deal with regional surgery, and include affections of the face, neck, mouth, throat, nose and accessory sinuses, diseases of the salivary glands, larynx, fractures of the facial bones and jaws, tumours of the jaws, diseases of the mandibular joint, the neck and eye. There is a concluding chapter on general anaesthetics in dentistry.

It is felt that some of the conditions described, such as diphtheria, scarlet fever and oral sepsis would more appropriately belong to the field of medicine. There are one or two points that might be criticized. Thus while it is agreed that lymphosarcoma of the tonsil is radiosensitive, it might have been emphasized that it is also markedly malignant. In addition there is some confusion over the terms "myeloid epulis"—which should be discarded—and "myeloma". Again it is felt that tracheotomy could have been described more fully and supported by illustrations.

But these points do not detract from the merits of the book, the size and purpose of which necessarily prevent the authors from going into any detail in most of the conditions that are described, and it will undoubtedly continue to be much used by dental students.

**Second Report of the Standing Committee on the Rehabilitation and Resettlement of Disabled Persons**

Ministry of Labour and National Service. London: His Majesty's Stationery Office, 1949. 20 pages. 25 x 15 cm. 9d. [£0.0375]

This Committee published its first report in November, 1946, and the present publication covers developments in the intervening period. During this time many of the emergency hospitals have closed and have given way to rehabilitation facilities, housed for the most part in hatted accommodation; there has been an extension of physiotherapy and occupational therapy facilities and gymnasia. The programme is still hampered by a shortage of auxiliary and medical personnel, and steps are being taken to remedy this. Among other measures, it is planned to open three new schools of physiotherapy.

The administrative arrangements under the National Health Service Act and the National Insurance Acts are outlined; these Acts have made possible a more integrated structure of the agencies dealing with rehabilitation problems. The schemes of rehabilitation for tuberculous patients, psychiatric patients, epileptics, and the blind are reported upon. The arrangements for the resettlement of the disabled under the D.R.O. (Disablement

Resettlement Officer) Service of the Ministry of Labour were strengthened in May 1946, by the appointment of 49 District D.R.O.'s. This Service is largely concerned with the economic resettlement of disabled persons, and through it an extensive programme of vocational guidance and further training is available. The quota scheme for the employment of registered disabled persons has worked so satisfactorily that in August 1948 less than one half of one per cent of these were unemployed.

Throughout, the report reflects the vigorous measures which are being taken to deal with the many problems of rehabilitation. The lessons learned by the rehabilitation services during the war period have not been without value.

### Report of the Departmental Committee on Industrial Diseases

Ministry of National Insurance. London: His Majesty's Stationery Office, 1948. 15 pages. 24 x 15 cm. 4d. [£0.0165]

A Departmental Committee on Industrial Diseases was appointed by the Ministry of National Insurance in March 1947, "to review, in the light of modern industrial conditions, the policy adopted in scheduling diseases as industrial diseases under the Workmen's Compensation Acts, and to advise as to the principles which should govern the selection of diseases for insurance under the National Insurance (Industrial Injuries) Act, having regard to the extended system of insurance to be set up by the National Insurance Act and any other relevant considerations."

The Committee, which was presided over by His Honour Judge Dale and on which there were four medical representatives, came to the conclusion that the tests which have hitherto been applied before a disease was scheduled by the Secretary of State under the Workmen's Compensation Acts are no longer appropriate. Under the Old Acts liability to pay compensation rested upon individual employers with separate interests; under a system of national contributory insurance circumstances are entirely different. Under Section 55(2) of the National Insurance (Industrial Injuries) Act 1946 the Minister is bound to satisfy himself, before prescribing a disease, that the attribution of particular cases to the nature of employment can be established or presumed with reasonable certainty; but otherwise he is given wide powers of discretion.

The Committee does not regard it as essential to prescription that a disease should be specific to employment, provided the employment necessarily implies a special exposure to the risk of the disease. This will appreciably enlarge the range of diseases which can be included, by enabling prescription of diseases that may occur in the general population.

Obviously such claims will need very careful scrutiny and the Committee recommends that a Standing Committee should be appointed by the Minister to advise on the selection of individual diseases for prescription.

T. F.

### Introductory Manual on the Control of Health Hazards from Radioactive Materials

Ministry of Supply, Atomic Energy Research Establishment. (Prepared for the Medical Research Council.) Issue No. 2. London: Medical Research Council, 1949. 15 pages. 24 x 18 cm.

This brief manual outlines the nature of the hazards to health attendant upon the use of radioactive materials in biological work and discusses the precautions which should be taken to safeguard the workers and prevent the falsification of

experimental results caused by uncontrolled and random radiation. Certain laboratory rules and procedures are necessary for the safe handling of these substances: these must be followed meticulously if disaster is to be avoided. A useful reference list is given. This manual will be of great value to those who contemplate working in the rapidly expanding field of radiobiology. Copies of it, together with its companion memorandum, the Seventh Revised Report of the Recommendations of British X-ray and Radium Protection Committee, may be obtained free on application to the Secretary, Medical Research Council, 38 Old Queen Street, London, S.W.1.

D. F.

### Textbook of Anaesthetics

R. J. Minnitt & John Gillies. Seventh edition. Edinburgh: E. & S. Livingstone Ltd., 1948. vii + 568 pages; 229 figures. 22 x 14 cm. £1 10s. [£1.5]

It is no exaggeration to say that this has become the most popular textbook of anaesthesia in Great Britain and it well deserves its enviable position. Every aspect of the subject is adequately covered in such a clear and lucid fashion that the argument can be followed by any intelligent medical student at the first reading. At the same time there is sufficient "meat" in the book to be acceptable to the resident anaesthetist and it is only when the aspiring specialist is reading for the second part of the Diploma in Anaesthetics that he will require further information.

The 7th edition has been brought up to date by a chapter on curare by Dr. T. C. Gray, and one on some legal aspects of anaesthesia by Mr. J. Crossley Vaines, LL.M. Mr. L. B. Wevill has enlarged his section on local analgesia so that it now describes the actual infiltration and block techniques which it formerly only outlined. Professor John Boyes has also revised the subsection on regional analgesia in dentistry.

The illustrations are well chosen and clearly reproduced, while the excellence of the paper and printing reflect great credit on the publishers. It is difficult to find any serious criticism of the book.

C. Langton Hewer

### The Clinical Examination of the Nervous System

G. H. Monrad-Krohn. Ninth edition. London: H. K. Lewis & Co. Ltd., 1948. xx + 459 pages, 131 illustrations. 19 x 13 cm. 16s. [£0.8]

During the 27 years since it first appeared, Monrad-Krohn's book has established itself as one of the most useful short accounts of the clinical examination of the nervous system. Much fresh material has been added to this new edition, including an account of electroencephalography and additions to the section on ventriculography and encephalography. Additions have also been made to the illustrations, which form a valuable supplement to the text. The book will be particularly useful to senior students and newly-qualified practitioners. Production maintains the high standard of previous editions.

L. T. M.

### The Doctor and the Difficult Child

William Moodie. Second edition. New York: The Commonwealth Fund; London: Geoffrey Cumberlege, Oxford University Press, 1947. xiv + 231 pages. 22 x 14 cm. 11s. 6d. [£0.575]

### The Doctor and the Difficult Adult

William Moodie. London: Cassell & Co., Ltd., 1947. vii + 296 pages. 22 x 14 cm. 15s. [£0.75]

The value of the child guidance clinic is no longer in dispute; it has won its place to the medical firmament, and, in the larger cities at least, has largely dispelled the doubts and fears of parents in seeking advice and expert guidance when faced with a childhood behaviour problem. From his rich experience as Medical Director of the London Child Guidance Training Centre, Dr. Moodie wrote the first edition of *The doctor and the difficult child* in 1940: he now has brought out a 2nd edition which is substantially unaltered. The crowded years of the war, though of course they profoundly altered the living conditions of British children, and in particular caused separation problems and increased the stresses to which children and their parents were subjected, brought with them little change in the fundamental principles of child guidance. The children remain the same, and the problems of adjustment in war time are only exaggerations of those met with before the war. Hence, Dr. Moodie has seen little reason to make any profound alterations in his book.

*The doctor and the difficult child* is a straightforward presentation of the subject of child guidance; the general practitioner will find it a useful help in his approach to problems of childhood maladjustment. Dr. Moodie approaches these problems in a commonsense way; the illustrative cases give the reader considerable insight into the genesis of behaviour problems; questions of treatment are not, perhaps, outlined in sufficient detail to be of much value to those who wish to put the author's methods into practice. The child psychiatrist will find little new in this volume, but it is not to him that it is primarily addressed.

*The doctor and the difficult adult* was published in 1947. The discursive style and the wide range of this volume prevent a logical development of its various topics: the book ranges over the whole field of psychiatry, and much of it is taken up with illustrative case histories. Here again, the case histories are extremely well written in that they give a vivid picture of the patients and their troubles, but the comment on them fails to elaborate the psychopathology involved and treatment is discussed only superficially.

Dr. Moodie takes exception to the views of the orthodox psychoanalysts. "The principles of psychoanalysis", he says, "cannot be applied directly to conscious thought or behaviour any more than those of Einstein and Rutherford can to the practical problems of physics." He sets up a category of Freudian enthusiasts which he calls Those Who Believe in Psychoanalysis; on these he pours his scorn. Yet it is clear that in his own clinical methods he daily employs Freudian principles.

However, Dr. Moodie's approach to the practical problems of psychiatry is refreshing and clear headed: the book is not intended for psychiatric specialists, but should be read with interest by general practitioners.

D. F.

### Manual of Leprosy

Ernest Muir. Edinburgh: E. & S. Livingstone Ltd., 1948. viii + 208 pages; 70 figures. 22 x 14 cm. 17s. 6d. [£0.875]

The production of a work on leprosy, comprehensive, accurate and interestingly written within the compass of 200 pages, could be carried out only by an enthusiast and an expert.

The author has been an ardent student of leprosy for many years in parts of the world where the disease is rife—in India, in Africa and in the West Indies. The book may, therefore, justly be called authoritative. The subject is dealt with in three parts, each with several chapters. In Part I, "The Nature of Leprosy", the author considers the bacteriology, mode of infection, the lepromin test,



the different types of the disease and their classification. Part II is on diagnosis by clinical and bacteriological examinations and skin tests. Exceptionally useful is a chapter on differential diagnosis. Treatment is included in Part II, in four chapters; one on the value and importance of good hygiene and the maintenance of a high general state of health, for resisting progress of the disease; hydriocarpus oil and the sulphones are then dealt with, and, finally, surgical measures. Part III describes anti-leprosy campaigns—the taking of a preliminary leprosy survey (data for an intensive survey are considered in an appendix), organizing control measures, establishing leprosaria and social and welfare services; the question of the healthy children of infected parents is discussed.

The work is embellished by excellent and well-selected photographs and photomicrographs, and the coloured plates depicting details are remarkably good. There is a carefully chosen bibliography for readers wishing for further information on the subject of each chapter, but no mention is found of the *Tropical Diseases Bulletin*, in which the literature of leprosy is reviewed and abstracted each month and there is every year a summary of the published work of the previous 12 months; this is of great help to anyone wishing to keep himself au courant with the advances in the subject.

To sum up: this book covers the ground efficiently and without redundancies; the author is to be congratulated on the successful result of his task and on having found a publisher who has done all that could be done in the way of quality of paper, printing and production to make the work attractive. For the practitioner going to a country where leprosy prevails there could be no better guide.

H. Harold Scott

### Genetics, Medicine, and Man

H. J. Muller, C. C. Little & Laurence H. Snyder. Ithaca, New York: Cornell University Press; London: Geoffrey Cumberlege, Oxford University Press, 1947. viii + 158 pages; 29 figures. 23 x 15 cm. 12s. 6d. [£0.625]

*Genetics, medicine, and man* consists of the Messenger Lectures on the Evolution of Civilization delivered at Cornell University in the autumn of 1945. An introductory preface has been contributed by R. A. Emerson of the same University, and the three authors, H. J. Muller, C. C. Little & Laurence H. Snyder, are all notable workers in the field of genetics in the USA. The book should be of wide interest; it serves as an introduction to the principles of heredity and shows how the results of recent experimental work in animals and plants have led to research in problems of human welfare. The book is divided into three parts; each author has contributed one section, which, in every case, is followed by a useful select bibliography and a list of references.

The first section, written by H. J. Muller, is a simple but comprehensive description of the nature of genes and of genetic activity. Clear diagrams of stages from the fertilization of the egg to the polarization of chromosomes in the dividing cell are useful adjuncts to the chapter on the work of the genes. This contribution, as a whole, shows the tremendous advances of genetics in less than 50 years.

C. C. Little, writing in the second section, on a definitive interpretation of genetics in relation to parental influence, says that this, indeed, is no field of this influence is demonstrated by a list of ways in which, in the mammal, it may be transferred to the offspring; and where, in the offspring, parental influence may show its effect. The following

chapter, on the influence of growth in cellular fission, describes the latent power of regeneration and the conflict arising between the organization of a cell community and the inherent factor of independent metabolism, within that community. Included in this chapter is a discussion on individuality, of which the author gives a definite genetic analysis.

The last section, by Laurence H. Snyder, is devoted to human heredity and the mutant gene in man. The author points out the difficulty of establishing genetic data in the human being, except in the cases of families with some exceptional physiological trait. After a consideration of practical applications and a list of hereditary traits, the author gives an account of the Rh factor. The location of genes, illustrated by several tentative maps of chromosomes, and the basic relations of the mutant gene, are described in the next chapter. A number of tables appear, containing lists of traits reported to be dependent upon certain types of genes.

S. S.

### Some Common Psychosomatic Manifestations

J. Barrie Murray. London: Geoffrey Cumberlege, Oxford University Press, 1947. xii + 101 pages. 18 x 12 cm. 7s. 6d. [£0.375]

This small book is devoted mainly to a description of "effort syndrome" or neurocirculatory asthenia; there is also a chapter on a less clearly defined condition described as the "low back syndrome". The author includes a number of original observations on the psychoneuroses as seen in military and civilian patients. The chief signs and symptoms of effort syndrome are discussed at length, and comparative figures are given for their incidence in groups of patients suffering from undifferentiated psychoneuroses, effort syndrome and the "low back syndrome". The symptoms may generally be regarded as physical expressions of anxiety or of other emotion. Possible predisposing causes and precipitating factors are enumerated; while the principle of multiple etiology is accepted, the importance of psychogenic factors is stressed. Dr. Murray points out that effort syndrome is common among civilian as well as military patients; it may also co-exist with tuberculosis, rheumatic carditis and other forms of organic disease, which then present a modified clinical picture. In the "low back syndrome" are included patients who complain of pain or other sensations in the lower part of the back or abdomen, or in the legs. Of those described as being in this category, 50% gave a past history of "nervous trouble", 38.5% complained of increased frequency of micturition, 54% showed hyperaesthesia to pin prick in the sacro-iliac region and 66% had anaesthesia of the skin in other regions.

Dr. Murray starts the chapter on treatment by saying: "The treatment of patients complaining of psychosomatic manifestations is obviously by psychotherapy." In considering physical exercise as a method of treatment he continues: "By graded exercises Lewis obviously treated his patients by mass psychotherapy, but obviously he was not entirely convinced of the purely psychiatric nature of the complaint and was prevented from treating it wholeheartedly by psychotherapy." Here, and elsewhere, Dr. Murray's long experience as a psychiatrist enables him to arrive at conclusions which may be less obvious to the ordinary medical reader and which would appear to merit a more critical examination. We are told that "... the eye signs in thyrotoxicosis are due to the emotional factor in this condition", but it is not made clear why the eye signs should be generally more marked

in thyrotoxicosis than in the affective states, where the emotional factor is presumably more prominent; nor is it clear how the emotional factor can account for the occurrence in thyrotoxicosis of unilateral exophthalmos. A further explanation of points of this kind would be of value.

The book will serve a useful purpose in drawing attention to the psychosomatic nature of some of the symptoms commonly encountered in ordinary medical practice. The format of the book is in keeping with the usual high standards of the Oxford University Press.

Derek Richter

### Thyroid Enlargement and Other Changes Related to the Mineral Content of Drinking Water. (With a Note on Goitre Prophylaxis)

Margaret M. Murray, R. A. Ryle, Beatrice W. Simpson & Dagmar C. Wilson. London: His Majesty's Stationery Office, 1943. (Medical Research Council Memorandum No. 12.) 39 pages. 24 x 15 cm. 9d. [£0.0375]

The work reported in this memorandum derives from the observation of an unusually high incidence of goitre in Oxfordshire noted during nutritional surveys early in the war. The purpose of the present study was to ascertain the relation between the iodine content of the drinking water supplied and the incidence of goitre; it was also hoped to study the relationship of endemic goitre with endemic fluorosis. This latter aim was not attained, because in England few areas exist with waters of sufficiently high fluoride content. Four areas of England were studied; in them 1,737 children, aged 11 to 15 years, were examined and the presence or absence of thyroid enlargement was graded on clinical grounds. The results confirmed the generally accepted view of the inverse relationship between thyroid enlargement and the iodine content of the drinking water.

Other surveys were made covering a wider area of England and Scotland. In these, nearly 4,000 children were examined, and it was found that the incidence of thyroid enlargement was greater in some areas of England, and less in some areas of Scotland, than would have been expected from the iodine content of the drinking water. Further investigation showed that this might be attributed to the degree of hardness of the English water as compared with the softness of the Scottish water.

The authors question whether clinical enlargement of the thyroid should ever be regarded as physiological: in areas with waters of high iodine content its incidence is very low. The prophylactic use of iodized salt is recommended.

D. F.

### Psychopathology: a Survey of Modern Approaches

J. Ernest Nicole. Fourth edition. London: Baillière, Tindall & Cox, 1946. vii + 268 pages. 22 x 14 cm. 15s. [£0.75]

This book has served many students as a guide to modern approaches to psychopathology since the 1st edition was published in 1930. The fields surveyed have, however, become so numerous and specialized that the student, contemplating the *hortus siccus* of theories and authors here displayed, might reasonably conclude that he was being given a lot of information about approaches but very little about how to arrive. The fault lies with psychopathology rather than with Dr. Nicole who has conscientiously set out the diverse opinions and observations published in the last forty years. He does not sit in judgement on them, even in respect of the amount of space they shall receive: the chapter called "Freud's Psychoanalysis", for example, takes up no more pages than are

given collectively to "Watson's Behaviourism", "Kempf's Psychopathology" and the "Endocrine Theories of Berman and Others"; yet it is evident from other chapters that Dr. Nicole rates the importance of Freud's work higher than this would suggest. Thirty pages of bibliography and an index containing a thousand names attest the wide range of the book, the author's fairness in including writers of very diverse standpoints, and his almost excessive concern to list even the minor contributors to some of the topics he deals with.

A. L.

### Hospital and Community. I. Hospital-treated Sickness amongst the People of Stirlingshire

Nuffield Provincial Hospitals Trust, London : The Nuffield Provincial Hospitals Trust, 1948. xii + 96 pages ; 3 maps. 24 × 16 cm. 3s. 6d. [£0.175]

The Glasgow Health and Sickness Bureau, founded some years ago by the Nuffield Provincial Hospitals Trust, attempted in this survey to assess the amount of hospital-treated sickness and thereby to fill a statistical gap in the Registrar-General's Annual Reports. The survey was, in itself, an experiment, primarily designed to ascertain hospital facilities and conditions throughout a given area. Stirlingshire was chosen as the area in which the survey was carried out, partly because it was believed that the several interests concerned would co-operate in such a survey, and partly because the population was of a reasonable size for investigation.

Information regarding natives of Stirlingshire being treated either as in- or out-patients in hospitals outside the county boundaries was collected, card-indexed and classified, together with hospital attendances in Stirlingshire itself. Many interesting facts were brought to light by these statistics, which include sex and age ratios, duration of hospital treatment and incidence of disease among certain population groups. The survey has also indicated a relationship between illness, social conditions, and industry. Respiratory and infectious diseases, for example, showed their strongest incidence in areas of over-crowding and housing shortage—conditions which are prevalent in Scotland generally. The lowest recorded number of patients per 1,000 of the population occurred in the western agricultural district of Stirlingshire. Results of hospital treatment and after-care were also given their places in this comprehensive survey. Supplementary notes in appendix form, at the end of the report, provide additional information on disease groups.

A history of the work done since 1889 in Falkirk Royal Infirmary, formerly known as Falkirk Cottage Hospital, forms the last chapter of this report and is entitled "The Growth of a District Hospital". The effect on the hospital of national health service schemes during half a century are described and statistics relating to patients during the same period are recorded.

S. S.

### Bacterial and Virus Diseases : Antisera, Toxoids, Vaccines and Tuberculin in Prophylaxis and Treatment

H. J. Parish. Edinburgh : E. & S. Livingstone Ltd., 1948. 168 pages ; illustrations. 19 × 13 cm. 7s. 6d. [£0.375]

The short title *Bacterial and virus diseases* appearing on the cover of this little book is very misleading as to the scope of the contents: this is, however, adequately described by the sub-title. Dr. Parish has worked for many years on the bacteriological side of the Wellcome Physiological Research Laboratories and knows intimately the

laboratory side of antisera, vaccines and so forth; he has further had much to do with their practical application in the field. As would be expected, he has been successful in bringing together in a small compass the practical information necessary for the senior student and practitioner. The book is rather a mixture of the elementary and the specialized. Thus under "Antitoxic Sera" one reads "Some organisms produce poisonous substances in the media in which they are grown" and is invited to admire coloured pictures of six common organisms. On the other hand most of the book is devoted to detailed practical instructions as to diagnostic and immunizing techniques.

C. H. Andrewes

### Diseases of the Eye

John Herbert Parsons & Stewart Duke-Elder. Eleventh edition. London : J. & A. Churchill Ltd., 1948. viii + 732 pages ; 21 plates ; 368 text-figures. 21 × 14 cm. £1 10s. [£1.5]

When does a textbook deserve to be called a "classic"? One may safely hazard the opinion that Parsons' *Diseases of the eye*, now jointly produced by Sir John Herbert Parsons and Sir Stewart Duke-Elder, which has been in the hands of every English-speaking ophthalmologist for the 41 years of its existence, has earned a place among the classics along with revered volumes such as that of Fuchs. Times change and the science of ophthalmology and—to a less extent—the art of ophthalmic practice change also, but "Parsons" goes on steadily and, in its 11th edition, continues to offer a firm and reliable foothold for the ophthalmic student and practitioner.

The present edition has been carefully revised and is brought up to date by the inclusion of much new matter, although a cautious and discreet conservatism in some respects—evidently intended by the authors—is apparent, especially in regard to recent developments in chemotherapy. The book is comprehensive in content, fully and excellently illustrated and indexed, and will receive a hearty welcome from all those who wish to make ophthalmology their life's work, for it provides a valuable, and indeed indispensable, introduction to the subject.

H. M. Traquair

### Nutrition and Diet Therapy

Agnes E. Pavey. London : Faber & Faber Ltd., 1948. 304 pages ; 1 chart. 21 × 13 cm. 12s. 6d. [£0.625]

A book from the author of *Clinical procedures* is always welcome, and her readers will find this one practical and informative. It is intended for nurses, but should appeal to a wider circle. The chapter headed "Diet in the Aged," for example, could be read with profit by all who have the care of the elderly. All those responsible for communal feeding should note her paragraph on the re-heating of green vegetables (p. 80). It is a familiar fact to many that vitamin C is lost in the process, but an attempt is not always made to "compensate for the defect" by including other suitable foods in the menu.

The second half of the book, on diet therapy, will probably appeal particularly to nurses. It is to be noted that the Meulengracht diet is well covered in two pages, and recent advances are not overlooked in the sections on vitamins and on coeliac disease. Some particularly attractive receipts for making refreshing drinks from easily obtainable ingredients are included in the section on beverages for the sick (pages 270–279). A rather unnecessary apology is made in the preface for inability "to set out menus in a spacious and attractive manner" owing to paper economy

standards. Though not "spacious" they are certainly "attractive", and the publisher is to be commended for producing such a well-printed, modestly priced book under present conditions. The historical circumstances behind the story of nutrition are unobtrusively introduced and lend interest to the book as a whole. Readers who wish to know the nutritive values of common foods will be pleased to see that these are included in the appendix.

F. T.

### Diseases of the Heart and Circulation

Albert A. Fitzgerald Peel. London : Geoffrey Cumberlege, Oxford University Press, 1947. xxi + 398 pages ; 61 figures. 22 × 14 cm. £1 15s. [£1.75]

Intended for students as well as for practitioners, *Diseases of the heart and circulation* is based primarily on the notes of lectures; a fact which may account for its somewhat rambling and discursive style. There are many rather tedious accounts of cases and references to the author's experience. The illustrations are often poor, the captions tend to be far too long, and many of the cardiograms are of poor quality. Examples are given of various artefacts, but these are so common in the other curves that they are superfluous. As regards the subject-matter, there is much to criticize. The account of dyspnoea is far from adequate; such an important symptom needs clearer and more up-to-date exposition. The same applies to cardiac pain. The description of gallop rhythm and the various abnormalities in the heart sounds is thoroughly confusing; "Osler's nodes" surely deserve a better account in an Oxford publication. The diversity of opinion as to left bundle-branch block referred to in the caption to fig. 23C has surely been long dispelled. One finds practically no reference to digoxin; cardopbylin is not mentioned.

This book has but little to commend it; there are too many obscurities, inaccuracies and omissions. The student will, however, find a fair amount of the usual facts which appear in all textbooks on this subject.

### The Pharmaceutical Pocket Book

Pharmaceutical Society of Great Britain. Fifteenth edition. London : Pharmaceutical Press, 1948. x + 427 pages. 18 × 12 cm. 12s. 6d. [£0.625]

Two circumstances have combined to make this edition of more than usual interest: the inauguration of the National Health Service in July 1948, and the publication of the seventh *British Pharmacopoeia*. The one involves many changes in the daily routine of the pharmacist; the other reflects the great advances in medical science and practice in the past decade and a half. The 15th edition of *The pharmaceutical pocket book* has been extensively revised to meet the changed conditions; it will continue to serve its dual purpose both as an introductory text for the student of pharmacy and as a practical manual for the practising pharmacist.

D. F.

### Disorders of Sex and Reproduction: Aetiology, Diagnosis and Treatment

A. P. Pillay. London : H. K. Lewis & Co. Ltd., 1948. xiv + 299 pages ; 2 plates ; 2 graphs. 22 × 14 cm. 18s. [£0.9]

The author has here not written a book primarily for the specialist, but a guide for the general practitioner. It does not claim to be complete, but will be useful to those who wish to treat the many thorny problems relating to sex. The work

is largely based on the author's own case records, which make useful and illuminating reading. Dr. Pillay has found that the majority of male sex disorders, exclusive of sterility, are caused by psychic factors, so that the family doctor, with his constant and close contact with his patients, and his sound common sense, is well suited to treat the type of case described in this work.

It is obvious that some of the cases quoted are non-European, and the case on p. 31, which the author quotes to illustrate sterility due to ignorance, would be difficult to parallel in Britain where even adolescents are taught, or have some knowledge of, what are popularly called "the facts of life".

Every attempt has been made to be as up to date as possible. There are no less than three chapters on endocrines in sex disorders, and the technique and history of artificial insemination are dealt with in the concluding chapter. But it is the psychological aspect with which the author is most at home, and it is fitting that the book is dedicated to Havelock Ellis.

F. T.

### Diccionario Inglés-Español y Español-Inglés de Términos Médicos y Biológicos

F. Plens y Sanz de Bremond & C. G. Turner. Madrid: Librería Editorial Científico Médica, 1947. 776 pages. 16 x 11 cm. 90 ptas.

This dictionary is the joint work of a philologist and a surgeon; the latter, Dr. C. Gil Turner, is a member of the Madrid medical faculty and an assistant professor of surgery.

The need for more and better Spanish-English and English-Spanish medical dictionaries is considerable, and even modest vocabularies, carefully compiled and edited, can play a useful part in meeting it. It is disappointing, therefore, that the present work cannot altogether be reckoned among these.

Some 19,000 Spanish-English equivalents, and a rather larger number of English-Spanish ones, are given. The biological terms specially mentioned in the title seem to be those which are normally included in any fairly comprehensive medical dictionary. In dealing with Spanish terms which have both medical and non-medical equivalents, the latter might well have been omitted in favour of some examples of the use of the former; e.g., for "Contador", the equivalents given are "Accountant, counter", for "Cardenal", "Ecclesiast, cardinal of the church", without distinction in either case. These same non-medical equivalents are in turn listed in the English-Spanish section. Instances are "Goblin", a non-medical equivalent of "Coco", and "Parish [sic] priest", an equivalent of "Cura". It is less easy to guess how "Gay dog", "Mother-in-law", "Packs of hounds", "Pastry-cook's shop", and "Roast beef" appeared on the medico-biological scene.

It is also clear that the compilers are not well acquainted with the ordinary arrangement of an English dictionary. Seven terms are alphabetized under the indefinite article "a", one under "an", and six under "the"; while "Each division of an orange" makes an unexpected beginning for the letter "E".

The Spanish-English section is, naturally, free from these defects, and constitutes a reasonably comprehensive and useful word-list. Mistakes in English spelling, which unhappily abound in both sections, are less important here as they do not affect alphabetical order.

B. M. S.

### Medical Education

Ffrangcon Roberts. London: H. K. Lewis & Co. Ltd., 1948. xv + 172 pages. 22 x 14 cm. 12s. 6d. [£0.625]

Not all will agree with Ffrangcon Roberts' views on the vexed questions of medical education, but most will feel that he has achieved a realistic and common-sense appraisal of the problem of what and how to teach medical students. He takes the view that medicine is essentially a vocational study; in the nature of things, most of its graduates will be general practitioners; the general plan of medical education must, therefore, be adapted to the needs of these. He feels that success in the practice of medicine "... depends largely on a knowledge of human nature and a sense of proportion, attributes which the increasing pressure of formal studies tends to extinguish." Reform of the medical curriculum has been a more or less continuous process for the past sixty years; the accelerating rate of the increase of scientific knowledge again makes an overhaul desirable.

This pragmatic approach carries with it certain implications as to the content and emphasis of premedical, preclinical and clinical teaching, and these the author explores to the full. He would reduce the volume of facts taught by rigidly excluding certain subjects such as comparative anatomy and certain parts of histology, and in general by restricting the facts taught to those necessary for medical practice. He is an enthusiastic advocate of the wider use of medical films, and would apply progressive methods such as the Dalton Plan to the teaching of physiology; in this plan small groups of students restrict their studies to intensive work on a prescribed topic; this requires the detailed consultation of the original literature and confirmatory and original laboratory experiment. It is claimed to allow every student the opportunity of developing his special inclinations, and to encourage independent judgement.

Dr. Roberts extends his study to clinical and hospital teaching; though sharply critical of certain aspects of present-day practice in this field, he is, in the end, a constructive critic. There is a lucid chapter on hospital training and another on the comparison of the types of cases seen in hospital with those seen in practice. This comparison underlines the limitations of hospital experience in the training of general practitioners.

Dr. Roberts' book is one which should be read by all those concerned with medical education: even those who disagree with his remedies will profit by exposure to his criticisms.

D. F.

### Recent Advances in Sex and Reproductive Physiology

J. M. Robson. Third edition. London: J. & A. Churchill Ltd., 1947. xii + 336 pages; 65 figures. 21 x 14 cm. £1 1s. [£1.05]

A glance at the long lists of references appended to the end of each chapter is sufficient to indicate the wide reading on which this work is based. As Professor Crew states in the foreword: "Its author knows his subject and, what is equally important, enjoys discussing it." Much of the work really is "recent" and includes references to writings published in the same year as the publication of this book.

The chapter entitled "Clinical Applications" should appeal particularly, and contains a good summary of the various pregnancy tests. There is also a useful table, showing relative doses, in the section of the clinical use of oestrogens. Hormones are well represented and progesterone has a chapter to itself.

The book will be found useful as a reference work, particularly when a short paragraph is desired on a subject not easily accessible in the ordinary textbook, e.g., body temperature and the menstrual cycle, or an authoritative review of present knowledge on

such a topical but controversial subject as artificial insemination. It may be said that a rather unwieldy mass of material has been summarized with no mean skill, for which others besides gynaecologists, physiologists and endocrinologists will be grateful to the author.

F. T.

### The Science and Practice of Surgery. Volumes I & II

W. H. C. Romanis & Phillip H. Mitchiner. Eighth edition. London: J. & A. Churchill Ltd., 1948. Vol. I: General surgery. vi + 892 pages; 20 plates; 439 text-figures. 24 x 16 cm. Vol. II: Regional surgery. vii + 955 pages; 8 plates; 316 text-figures. 24 x 16 cm. £1 5s. per volume [£1.25]

This standard and deservedly popular textbook of surgery reaches its 8th edition on its twenty-first birthday and the authors are to be congratulated on the continued success of their work. Their work to a very large extent it remains, although a few chapters are contributed by other writers. A chapter on diseases of the eye has been omitted from this edition, but new chapters on plastic surgery and x-ray therapy have been added. Both of these are excellent. The other contributed chapter (on anaesthetics) and the section on venereal disease have been revised and brought up to date.

The excellence of these contributed chapters and of their illustrations tempts comparison with other sections of the book and raises the question as to whether in the now highly specialized state of surgery a textbook of the size of this one can in fact be kept thoroughly up to date by one or two authors, particularly when a new edition is called for every two or three years. While the authors state that the whole work has been thoroughly revised, careful perusal reveals some weak points in the revision. It is surprising, for example, to find no mention of high subcutaneous injection of phenol in oil as a treatment of haemorrhoids while "the regular introduction of a rounded vulcanite or ebony rod of the type of the 'Little Wonder', which is rubbed up and down" is advocated as a possibly successful treatment in early cases! Some of the illustrations are out of date and might with advantage be changed.

These however are minor criticisms. This is an excellent textbook for the use of students and practitioners. Due regard is paid to pathology, and in the regional section excellent descriptions of the appropriate anatomy and physiology are given in each chapter and a brief but adequate description of the main operative procedures adds to the value of the work and gives it a completeness often lacking in similar textbooks.

T. M. Miller

### Post-Mortem Appearances

Joan M. Ross. Fifth edition. London: Geoffrey Cumberlege, Oxford University Press, 1949. ix + 303 pages. 17 x 11 cm. 8s. 6d. [£0.425]

The demand for a 5th edition of this small book, since its first publication in 1925, is a proof of its general usefulness. Apart from minor alterations and additions, this edition is similar to the preceding one. This is what one might expect, since even with the advance of knowledge only the interpretation of some of the post-mortem appearances would require revision. Perhaps the only factor, apart from new industrial diseases and the effects of modern warfare, which has brought about changes during the past 20 years in post-mortem findings, is the development of chemotherapy. For example, classical lobar pneumonia has become

very rare; on the other hand, renal failure caused by sulphonamides has become known.

According to the author this volume "has been a veritable passport" for her; one might say confidently that it has served and it will continue to serve a like good purpose for its readers.

G. P.

### The Nomenclature of Disease. Drawn up by a Joint Committee Appointed by the Royal College of Physicians of London

Royal College of Physicians of London. Seventh edition. London: His Majesty's Stationery Office, 1948. xiv + 386 pages. 24 x 15 cm. 8s. 6d. [£0.425]

Extensive changes are apparent in the 7th edition of the *Nomenclature of disease*, recently issued by the Joint Committee appointed by the Royal College of Physicians, and drawn up with the assistance of a Sub-Committee on Classification. The number of entries is almost double that in the previous edition, and the new edition adheres very closely in some respects to the *Standard nomenclature of disease* published by the American Medical Association. In the first section is given an etiological classification of disease, which is then applied to the body as a whole and to its systems. A new feature is a list of medical eponyms, one of the most comprehensive so far available, although the compilers wisely recommend the use of the synonyms proposed for them. The index to a nomenclature of disease is always an important section; in the present publication the index forms a third of the book and comprises more than 17,000 entries. The very low price is no doubt due to the intervention of His Majesty's Stationery Office as publishers.

L. T. M.

### Vade Mecum of Medical Treatment

W. Gordon Sears. Fifth edition. London: Edward Arnold & Co., 1947. vii + 407 pages. 18 x 11 cm. 10s. 6d. [£0.525]

This work continues to be deservedly popular with the busy practitioners and senior students for whom it is written. The alphabetical arrangement of the sections facilitates quick reference, and the revision they have undergone in this edition (notably those on Addison's disease, gonorrhoea and purpura) has increased their usefulness. Where necessary the background to treatment is briefly indicated in the opening paragraph in a clear, easy style. Mention must be made of the appendices on the sulphonamides and penicillin, and of the many useful tables. Printed on thin paper, unlike the pre-war editions, it can easily be slipped into the pocket.

F. T.

### Textbook of Gynaecology

Wilfred Show. Fifth edition. London: J. & A. Churchill Ltd., 1948. vii + 660 pages; 4 colour plates; 292 text-figures. 22 x 14 cm. £1 5s. [£1.25]

An up-to-date British textbook on gynaecology (the 4th edition of this work was first issued in 1945) is badly needed, so a revised edition of one of the best of the established textbooks is doubly welcome. New knowledge has been incorporated in the present edition, and the whole work drastically revised and in part re-written. Gynaecology is admirably surveyed in 26 chapters in the clear, easy style that has established this book as a firm favourite among practitioners and students since it first appeared in 1936.

Penicillin is now well established in the treatment of gonorrhoea and is dealt with in Chapter 6. Incidentally, penicillin does not appear as a heading in the index though the sulphonamides are included. Readers who recall the author's contributions on ovarian tumours to past editions of *Recent advances in obstetrics* will be pleased to see the corresponding section in the textbook, which includes the new classification (p. 584). Special mention must also be made of the chapter on radiological treatment in gynaecology, and one is glad to note that the author decided to retain his own photomicrographs. The new edition should maintain the popularity of the work as a standard textbook.

F. T.

### Food and Health

Henry C. Sherman. Second edition. New York, The Macmillan Company, 1947. x + 290 pages. 22 x 15 cm. £1

This book is a completely revised and reset edition of the author's very useful and semi-popular account of food in relation to human health. In its pages there is amply demonstrated the contributions made by recent work in this most vital of all topics, but in such a fashion as not to embarrass the lay reader with the exact details of the biochemistry and physiology of nutrition. Comparison between the 1st and 2nd editions indicates the very considerable amount of new knowledge that has resulted from the investigation of the years between.

As in all preventive medicine, stress is rightly laid on the positive aspect of health—not merely freedom from disease but buoyant health. While the original character of the work is preserved, four additional chapters have been added: three of these arise from partitioning the former chapter on the place of different foods in the dietary, and the fourth concerns "How Foods affect Health and Efficiency through Nutrition."

The expert as well as the lay reader will find concise summaries of various aspects of nutrition written in a lucid and attractively plain style. Those which relate to the beneficial effects that may be expected to accrue from optimal nutrition should be read by those who administer food policy.

The closing chapter is followed by the full text of the United States National Research Council's *Recommended dietary allowances* and this by a table which gives the nutritive values of a liberal number of typical foods so that the reader can translate these recommended allowances into actual meals. British experience does not substantiate all these recommendations and a measure of healthy scepticism about their adoption should be in our minds when reading these closing chapters.

There is a well-selected bibliography for those who wish to read more deeply on this most entrancing and topical subject.

D. P. Cuthbertson

### Les Algies des Amputés

A. Sliaberg. Paris: Masson & Cie, 1948. 110 pages; 17 figures; 1 plate. 25 x 16 cm. 300 fr.

This study is based on the author's own observations of 217 patients, on a thesis by another worker, and on dossiers supplied by the Fédération des Amputés de Guerre de France. 196 of the author's cases were casualties of the two World Wars, the remainder being attributable to earlier campaigns, accidents and to infectious processes.

The author states that his aim is to give as complete a clinical picture as possible of pain following amputation, and to abstain from any discussion of pathogenesis except where it contributes to the understanding of the clinical and therapeutic

aspects. He first describes the phantom limb, its incidence, postoperative date of appearance, apparent position, size, sensations of heat and cold, and involuntary movements, and the evolution of all these variable phenomena. The localization and general characteristics of pain in the phantom limb and stump are described at length, with short chapters on tonic and clonic contractions of the stump, radiating and referred pain, and precipitating and aggravating factors. Reflex disturbances of the circulatory, digestive and nervous systems are also discussed, and a chapter is devoted to the clinical examination of the stump. The results are recorded of treatment by medication, physiotherapy, and surgery. Prophylactic techniques in the actual amputation are also briefly mentioned.

The monograph is illustrated with drawings, charts, and tables; there is also one plate, which, however, adds little to the rest, as the theme of the work is hardly "photogenic". There is a bibliography of 126 references.

B. M. S.

### A Short History of Ophthalmology

Arnold Sorsby. Second edition. London: Staples Press Ltd., 1948. 103 pages; 7 illustrations. 19 x 12 cm. 8s. 6d. [£0.425]

The 2nd edition of Professor Sorsby's well-known and well-written short history of ophthalmology is substantially unchanged, although the opportunity has been taken to correct a few minor errors and make good some omissions. Although an exhaustive history of ophthalmology cannot be expected in a hundred pages, the author has managed, by careful and lucid writing, to include a great deal of information, and his book remains the most valuable short account of the subject available.

L. T. M.

### Physics and the Surgeon

H. S. Souttor. Oxford: Blackwell Scientific Publications, 1948. vii + 60 pages; 41 figures. 22 x 14 cm. 7s. 6d. [£0.375]

The purpose of this small volume is to help the surgeon to understand the human body as a physical mechanism and also to give some insight into the more recent advances in physical science which underlie radiology and radiobiology. In the first part examples of muscle action are used to illustrate the principles of classical physics, and short sections deal with the resistance of the skull to external force, the absorption of heat, the effects of pressure on the circulation and in the tissues, and the principles of electrotherapy. The second section gives a simplified outline of the atomic theory, radiation phenomena, and isotopes and their properties. It is clearly and interestingly written, but the scope of the book, together with its small size, precludes other than a simplified and superficial treatment of the subject-matter.

D. F.

### Clinical Chemistry in Practical Medicine

C. P. Stewart & D. M. Dunlop. Third edition. Edinburgh: E. & S. Livingstone Ltd., 1949. vii + 324 pages; 30 figures. 22 x 14 cm. 17s. 6d. [£0.875]

To cover a wide field in a short, clear book demands some degree of selection and dogmatism. That is to say no more than that this book must have the defects of its merits; but the merits themselves are now well established.

The book is conveniently and compactly arranged and has a good index. A short introduction stresses the need for a close relationship between the biochemist and the clinician, and appraises the value of biochemical methods in diagnosis, prognosis and control of treatment. Chapters are devoted to the basal metabolic rate; the mechanism of neutrality regulation; tests of renal, gastric, pancreatic and hepatic function; the proteins of blood plasma; the cerebrospinal fluid; calcium and phosphorus; and salt and water metabolism. In a final chapter brief sections are given to the erythrocyte sedimentation rate; phosphatase activity; uric acid; 17-ketosteroids; pregnadiol; nutritional deficiency; and the biological control of the use of powerful therapeutic agents.

In an appendix of 40 pages laboratory methods are described. A second appendix tabulates the normal chemical composition of human urine and its variation in disease; a third appendix deals similarly with the chemical composition of human blood.

P. W.

### Treatment of Some Chronic and 'Incurable' Diseases

A. T. Todd. Second edition. Bristol: John Wright & Sons Ltd., 1947. xi + 324 pages. 22 x 14 cm. £1 5s. [£1.25]

The 2nd edition of this work by the Honorary Physician of the Bristol Royal Infirmary appears 10 years after the 1st, and has been completely revised and largely re-written to add data obtained in the intervening years of medical practice. Much new material is included, especially relating to experience gained in the treatment of chronic mental illness. The author demonstrates the weakness of a system of therapeutics of chronic or incurable diseases based upon anatomical designations and outlook, and upon an attempt to unify the etiology of a disease. Chronic and incurable diseases must be considered as complex processes; they cannot be treated by simple and rapid methods. A description of procedures is given, some slow and difficult, but all proved effective by the author.

H. M. C.

### Haven Products. A Scottish Experiment in the Employment of Severely Disabled Men

A. E. Turner, T. A. Stirrat & T. Ferguson. London: Nuffield Provincial Hospitals Trust [no date]. 27 pages; illustrations. 31 x 24 cm.

This brochure is the story of the organization of a specially equipped factory for the employment of severely disabled men in Glasgow, described by the authors, one of whom is Professor Ferguson of the Public Health Department in the University of Glasgow, as an important experiment in social medicine. At the workshop, which is the outcome of the idea and work of industrialists and medical social workers, 45 disabled men are employed in a non-profit making concern. The methods by which this is done are described in detail, and the success of the venture is analyzed and judged accordingly to the regularity of attendance, output, financial stability of the enterprise and the effect on the men themselves. The authors maintain that this experience of two years has shown that many disabled men can work under certain special conditions, and their productive output compares favourably with that of normal workers.

M. M. T.

### Intelligence Tests for Children

C. W. Valentine. Third edition. London: Methuen & Co. Ltd., 1948. xiii + 60 pages; illustrations. 19 x 13 cm. 5s. [£0.25]

It has been the intention of the author of this little book to provide, for use with children from 2 to 15 years of age, a series of intelligence tests which require little or no apparatus. Owing to the comprehensive instructions given, they will be of particular value to those who have had no previous experience in testing. It has, however, been pointed out in the preface to the 1st edition that an expert tester is necessary when individual cases demand greater exactitude of I.Q. assessment. Regular testing during each stage of a child's school life has also been advocated.

The tests have been designed primarily to give some indication of general intelligence, but, as the author says, they also have a bias towards the detection of special abilities. Therefore a child's apparent failure in one particular age-group test does not necessarily indicate general dullness, but may be only a sign of backwardness in some aspect of his mental make-up, such as slowness in learning to speak. The tests follow a very similar formula, especially those designed for children between 6 and 15 years of age, becoming progressively more difficult through the age-groups. Mazes, analogies and opposites are common features of most tests, and examples for the assessment of reasoning powers occur more frequently in the testing of older children.

A small bibliography has been prepared for further study in mental testing.

S. S.

### Modern Treatment Year Book 1948: A Year Book of Diagnosis and Treatment for the General Practitioner

Edited by Cecil Wakeley. London: The Medical Press, 1948. xxv + 344 pages; 26 figures. 22 x 14 cm. 15s. [£0.75]

Readers who have searched the textbooks for the most up-to-date therapy and turned disappointed away will welcome the present volume. It is designed to bridge the otherwise unavoidable gap between the latest treatment and the latest textbook without scouring the periodical literature. Such diverse subjects as asthma, Ménière's disease, bronchiectasis, peptic ulcer, glaucoma, and breech presentation are surveyed in 38 articles. These are not arranged according to any rigid plan, but are written primarily to meet the needs of the busy general practitioner, needs which the editor has presumably assessed from the letters of those "innumerable doctors who have written . . . constructive criticisms of what is required by the average medical man" (Preface). The arrangement of the articles encourages the casual reader, while the index ensures that this does not detract from the value of the book as a work of reference. From the latter point of view it is a pity that only some of the articles have lists of references appended; these stimulate further reading.

The type of reader addressed is apparent in the scope of the contributions. Dr. Terence East on hypertension, for example, devotes most of his space to mental adjustment, life and habits, special symptoms, and drugs, discussing surgical treatment only in order to give the doctor a guide to the selection of patients who might benefit.

In conclusion, the price is very low, and the production admirable.

F. T.

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## Books Received

March 1948 — April 1949

Reviews of many of these books appear in this number of the Bulletin or will appear in future numbers

Abély, A. M. P., Assailly, A. & Laine, B. *Les facteurs vasculaires et endocriniens de l'activité*. 1948. L'Expansion Scientifique Française (Paris)

Addis, T. *Glomerular nephritis: diagnosis and treatment*. 1948. Macmillan (New York), £2

Aeff, M. A. *Bilateral cancer: radiological diagnosis and treatment*. 1948. Lewis (London), 16s. [£0.8]

Aguilar, O. P. & Queirel, J. *Bronconeumonectasias congénitas: quistes aéreos y ampollas gigantes de enfisema*. 1948. Editorial Vazquez (Buenos Aires)

Aguilar, O. P., Sirlin, G. & Schnier, M. *Tuberculosis pulmonar hemotógena*. 1948. Editorial "El Ateneo" (Buenos Aires)

Alliance Nationale contre la Dépopulation. *Trois journées pour l'étude scientifique du vieillissement de la population, 22-23-24 avril 1948. Compte rendu complet*. Vol. 1-3, 1948. L'Alliance Nationale (Paris), each volume: 50 fr.

Amsler, M., Brückner, A., Franceschetti, A., Goldmann, H. & Surell, E. B., editors. *Lehrbuch der Augenheilkunde*. 1948. Karger (Basel), 35 Sw.fr.

Anderson, W. A. D., editor. *Pathology*. 1948. Kimpton (London), £3 15s. [£3.75]

Andrews, G. W. S. & Miller, J. *Penicillin and other antibiotics*. 1949. Todd (London), 7s. 6d. [£0.375]

Argentina. Asociación de Ayuda y Orientación al Invalído. *Segunda conferencia para el bienestar del lisiado. Buenos Aires, octubre de 1946. Relatos oficiales, contribuciones y discusiones*. 1946. Asociación de Ayuda y Orientación al Invalído (Buenos Aires)

Ayman, D. *Arterial hypertension*. Edited by Henry A. Christian. 1948. Oxford University Press (New York); Geoffrey Cumberlege (London), 12s. 6d. [£0.625]

Azoy, A. *El vértigo: estudio fisiopatológico*. 1948. Manuel Marín (Barcelona), 50 ptas

Bailey, H. & Love, R. J. M. *A short practice of surgery*. Parts I-IV. 8th ed. 1948-49. Lewis (London), £2 12s. 6d. the set. [£2.625]

Bankoff, G. *The practice of local anaesthesia*. 3rd ed. 1948. Staples Press (London), £1 10s. [£1.5]

Bargmann, W. *Histologie und mikroskopische Anatomie des Menschen*. 1948. Thieme (Stuttgart), 19.60 Mk.

Barnes, J. *Gynaecological histology*. 1948. Harvey & Blythe (London), £1 10s. [£1.5]

Batty, R. J. *Erexis or bed-wetting*. 2nd ed. 1948. Staples Press (London), 9s. 6d. [£0.475]

Bannman, E. *Sterilisation and sterile Aufbewahrung von Spritzen und Hohlkadeln*. 2nd ed. 1948. Schwabe (Basel), 7.50 Sw.fr.

Beaumont, G. E. *A pocket medicine*. 2nd ed. 1948. Churchill (London), 9s. [£0.45]

Beaux, A. R. *Injeritos de piel*. 1947. Editorial "El Ateneo" (Buenos Aires)

Becke, H. C. *Psychiatry: theory and practice for students and nurses*. 2nd ed. 1948. Faber & Faber (London), 10s 6d. [£0.525]

Beck, I. F. *The almoner. A brief account of medical social service in Great Britain*. [1948] Council of the Institute of Almoners (London), 3s. 6d. [£0.175]

Bedford, T. *Basic principles of ventilation and heating*. 1948. Lewis (London), £1 5s. [£1.25]

Berg, C. *Clinical psychology. A case book of the neurases and their treatment*. 1948. Allen & Unwin (London), £1 5s. [£1.25]

Bentley, F. R. *Skin diseases in general practice*. (The Practitioner Handbooks.) 1949. Eyre & Spottiswoode (London), £1 1s. [£1.05]



- Beveridge. *Voluntary action. A report on methods of social advance.* 1948. Allen & Unwin (London), 16s. [£0.8]
- Biggart, J. H. *Pathology of the nervous system. A student's introduction.* 2nd ed. 1949. Livingstone (Edinburgh), £1 1s. [£1.05]
- Bigwood, E. J. *Enseignements de la guerre 1939-1945 dans le domaine de la nutrition. Un symposium tenu sous la présidence du professeur E. J. Bigwood dans le cadre du VII<sup>e</sup> Congrès de Chimie Biologique, (Liège, 3-6 octobre 1946).* (Médecine et Biologie, No. 6.) 1947. Desoer (Liège); Masson (Paris)
- Bing, R. *Kompendium der topischen Gehirn- und Rückenmarksdiagnostik. Kurzgefasste Anleitung zur klinischen Lokalisation der Erkrankungen und Verletzungen der Nervenzentren.* 13th ed. 1948. Schwabe (Basel), 25 Sw. fr.
- Biochemical Society. *The relation of optical form to biological activity in the amino-acid series.* Edited by R. T. Williams. (Biochemical Society Symposia No. 1.) 1948. Cambridge University Press (London), 5s. [£0.25]
- Biochemical Society. *The biochemical reactions of chemical warfare agents. A symposium held at the London School of Hygiene and Tropical Medicine on 13th December, 1947.* Organized and edited by R. T. Williams. (Biochemical Society Symposia No. 2.) 1948. University Press (Cambridge), 5s. [£0.25]
- Birch, C. A., editor. *Emergencies in medical practice.* 1948. Livingstone (Edinburgh), £1 5s. [£1.25]
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# Films

1408

## Bronchography

made at King Edward VII Sanatorium, Midhurst, Sussex, 1949; owned by the British Council; technical adviser, Dr. Foster-Carter; produced by Gaumont British Instructional Ltd.; available in 16 and 35 mm. sound, 1,338 feet [408 m.] and 3,346 feet [1,020 m.] respectively; black and white; 37 minutes

Bronchography is usually done by the house physician rather than by the consultant. It is a procedure for which a good technique is far better than good luck if useful radiographs are to be obtained regularly. The subject is an excellent choice for a film.

The film starts with a demonstration of the bronchial tree and of the advantages of having lateral and oblique views in addition to antero-posterior or postero-anterior views. Various methods of introducing the radio-opaque oil into the bronchial tree are then considered. Injection through the crico-thyroid membrane or trachea is taken as the standard method; the technique of injection is demonstrated, and the positioning required for filling the bronchial tree of each lung and the specific bronchi. Advice on exposure needed for taking the x-ray plates is given.

Instillation via mouth and nose is demonstrated and finally the method for young children, in whom general anaesthesia and intubation is recommended. Models and animated diagrams are used throughout to elucidate the principles and mechanisms employed, and the film ends with a recapitulation of the recommendations. The film is well photographed, and the recording of Alvar Liddell's reading of the commentary was, on the 35 mm. copy heard, excellent.

There is a great deal of detailed technique to be learnt by a beginner in this art and much of it is easily and best conveyed by film, but for other aspects the film will need to be reinforced by a leaflet if an adequate recollection is to be retained by the viewer who intends to go away and do bronchography without a tutor. The model used of the bronchial tree might well have been replaced, for all but the introductory shots, by a much simpler one showing only the main branches. The choice of the pertracheal technique as the standard method will not meet with universal approval even in this country. That it is occasionally followed by accident was noted. In view of the many possible accidents, which rarely may even be fatal, after injection through the tracheal wall or crico-thyroid membrane, it is probably best to avoid that technique wherever possible, especially as—with a good technique of positioning—satisfactory results are obtained after instilling the oil through the nose or mouth.

The method of doing the pertracheal injection is very well conveyed by the film. The great advantages of a three-ring syringe over the ordinary syringe might have been emphasized to those about to take up this work. The technique of positioning used after giving the oil and before taking the radiographs decides whether good bronchograms will be obtained regularly, and the film deals with this thoroughly. An exact memory of the steps which have to be followed might have been more easily retained if the demonstration on the patient had been reinforced with one on a manikin or a model, or if cine-radiography on an animal or a model had been used. A table of the successive positions and times for which they are held might have been recited, or shown being built up in a succession of sub-titles as each stage was performed. The practitioner seeing the film would then more easily carry away a clear idea.

This film deals with an eminently cinematic subject which is eminently worth doing in a thorough fashion. As an entertainment for medical audiences it is less successful than the film "The Technique of Artificial Pneumothorax" (British Council, 1946), but the necessary information on the subject is included. Those who will be learning from the film alone, and it is presumably for them that it is primarily made, will be glad to see it through several times.

Ronald Mac Keith

1409

## Polio—Diagnosis and Management

made at Wingfield Morris Orthopaedic Hospital, Oxford, Isolation Hospital, Abingdon, and West London County Council Hospital, 1948; owned by Central Office of Information; technical advisers, Professor H. J. Seddon, Dr. W. H. Kelleher, Dr. W. H. Bradley, Dr. T. S. R. Fisher & Dr. J. H. Fisher; directed by Geoffrey Innes; unit, Crown Film Unit; distributed by Central Film Library; available in 35 and 16 mm. sound, 5,508 feet [1,679 m.] and 2,278 feet [694 m.] respectively; monochrome; 60 minutes

In 1947 there was an epidemic of acute anterior poliomyelitis in England and at its height a 20-minute film, "Poliomyelitis 1947", dealing with early diagnosis, was issued and seen in three weeks by 17,000 general practitioners and as many nurses. The welcome it received suggested to the Ministry of Health that a more detailed film would be welcomed by the profession. A more reasonable decision, however, would have been to make a number of 20-minute films dealing with other topical and ever-present medical problems, for as a result of the interest aroused by the epidemic, and from numerous articles and the short film, most general practitioners in England had by then acquired a satisfactory working knowledge of poliomyelitis.

"Polio—Diagnosis and Management" starts with a review of the statistical aspects and then discusses the epidemiology of a family outbreak which included mild, non-paralytic as well as paralytic cases. The case of a young man is followed from the doctor's surgery to his home and on to hospital. The importance of early diagnosis is stressed and differential diagnosis discussed. An excellent point made is the reassurance of the patient's household and the instructions to them in taking simple precautions against the spread of the disease, though rather surprisingly the doctors take a cup of tea in the infected house from unboiled cups.

A rather lengthy sequence follows showing various muscle palsies in early cases in hospital. The young man's progress through various stages of treatment and rehabilitation is shown, in hospital, on his return home, while under the care of his own doctor and of the Ministry of Labour Disablement Resettlement Officer, and finally in an after-care clinic. This demonstrates the value that its control of time gives to the film as a teaching medium.

This film is designed for the medical profession and in particular for general practitioners. As an instructional film its great value is that it gives a view of the whole problem, so that the general practitioner may better understand the management of, and more actively help in, the patient's restoration to full health. As a formal instructional film it is lacking in a clear pattern that the viewer can carry away to help him recall the details of examination. It would, also, be better if it were shorter, in order to leave time for discussion and questions. But considered as a documentary film on the diagnosis and management of the disease in Britain today it deserves a warm welcome.

Ronald Mac Keith

1410

## The Multiple Pressure Technique of Vaccination

made and produced by Dr. Brian Stanford, 1949; owned by A. de St. Dalmas & Co. Ltd. of Leicester; technical adviser, Dr. W. H. Bradley; available in 16 mm. silent, 350 feet [107 m.]; colour; 10 minutes at 24 frames per second

This short coloured film demonstrates with great clarity the technique of vaccination by the multiple pressure method. This technique has been widely used in North America and certain advantages for it are claimed as compared with scratch technique: it is painless, equally rapid, and gives a higher percentage of satisfactory results. The film shows the technique as used in a four-months-old infant vaccinated at home and as practised on an adult re-vaccinated at the clinic. It should be used as a teaching aid; there is no sound track and it should be shown in conjunction with a brief lecture by an expert to elucidate the various points, or, alternatively, with a script to be read by the

audience. Certain points, such as the details of the skin preparation and the choice of agents for this are deliberately not detailed in the film itself, and the advantages of the multiple pressure technique are similarly omitted. It is hoped to add a sound track to the film, which will materially enhance its value. The film has been included in the Ministry of Health Film Library.

*D. Findlay*

1411

## Your Children's Meals

made in London in private houses, 1946; owned by Central Office of Information; technical advisers, Dr. G. Macdonald, Dr. H. A. Magee and Dr. Rachael Elliott; directed by Alex. Strasser; unit, Realist Film Unit; distributed by Central Film Library; available in 35 mm. and 16 mm. sound, 1,212 feet [369 m.] and 501 feet [153 m.] respectively; monochrome; 15 minutes

## Your Children's Sleep

made in London in private houses, 1947; owned by Central Office of Information; technical adviser, Dr. D. W. Winnicott; directed by Brian Smith; unit, Realist Film Unit; distributed by Central Film Library; available in 35 mm. and 16 mm. sound, 2,093 feet [638 m.] and 840 feet [256 m.] respectively; monochrome; 15 minutes

"Your Children's Meals" and "Your Children's Sleep" are two more films in the series made for the Ministry of Health. The earlier trio, "Your Children's Eyes," "Your Children's Ears" and "Your Children's Teeth,"<sup>1</sup> gave straightforward accounts of the how-they-work and how-to-keep-them-working-well type.

"Your Children and You"<sup>2</sup> led the way into the psychological field and the two films reviewed are further excursions there. It is clearly a wise plan to teach child-rearing because, while there has been a fall in child mortality and morbidity of recent years, it remains true that children are often less happy than they could be, and the rise in delinquency is disquieting. Contributions to the proper care of children, even though not of great immediate effect, are to be welcomed.

"Your Children's Meals" shows how appetite may be affected by the mental state of the child—when he is excited, tired or upset. The situation may be met by smaller helpings of food, by having company to meals, and so on. The value of a cheerful atmosphere, of food that looks attractive, and of punctuality and regularity, is shown by clever photography and effects.

This film has many good qualities and will be useful for showing to parents and others who are concerned in child care, provided that someone is there to introduce and to discuss the film after it has been shown. The film leaves a rather muddled impression as it refers to the need for firmness in insisting that children eat what is provided, even when this consists of green vegetables cooked until they lose all taste and food value. The error of forgetting to insist that children's food should be tasty is the more surprising when the director has wisely drawn attention to the need for meals to look attractive. The film has so many good points presented in so fascinating a way that it is a pity that better advice was not obtained at the stage of script writing. An experiment conducted in Chicago in 1935 showed that even very young children spontaneously select a balanced diet, and the general tendency of management of children at their meals has changed of recent years; while we still appreciate that the child lives in a community, we agree that his preferences need not be ignored.

"Your Children's Sleep" starts by reminding us that when a grown-up or child does not sleep it is for some cause. For example, a woman may be worried because she has lost her purse. Excitement and worry or tension from a feeling of failing to reach

a parent's ideals may all keep the child awake. There are excellent sequences to illustrate these points: some of them will be very easily remembered by anyone who has seen the film—the boy whose fantasies of success run on or the girl whose mother sets an adult standard of behaviour impossible for the child to attain, wakes screaming or relapses to bed-wetting. In addition there are sequences of symbolic shapes, representing the conquest of fears. These shapes mean a great deal to the man who evolved them but they do not, unfortunately, convey very much on a first showing. The fact that children's anxieties are as real as adults' is extremely well brought out. They are more intensely felt because children cannot consciously remind themselves that morning will come and the fears will go. The film ends by showing what can be done to help to ensure easy sleeping.

The whole film is polished, lucid, tranquil and persuasive. Its content is excellent and all who combined to make it are to be highly congratulated. One would guess that a very wise and experienced children's doctor or psychologist has helped in its making. The technical advisers' names should appear on the credit title of all films. Only so can they receive the blame or credit which is their due, and only so can the good advisers be asked to help with further films.

*Ronald Mac Keith*

1412

## Know Your Baby

made at Ottawa, Canada, 1947; owned by National Film Board of Canada; unit, Crawley Films Ltd.; available in 16 mm. sound, 394 feet [120 m.]; colour; 10 minutes

This film illustrates how best to deal with the arrival of a baby into the family circle, and lays special emphasis on the necessity for satisfying the emotional needs, both of the baby and of the older children.

We are shown a mother expecting a third child and, in order that the other children may have a proprietorial interest in it and consequently be less jealous, she involves them in preparations for the baby, including the painting of its cot. When the baby arrives he is shared by all, and the older children are given extra attention to reassure them of their parents' continuing love. The older children may regress to behaviour they had grown out of, wanting to be fed, or wetting the bed, but these are temporary troubles, to be solved by convincing the children that their parents still value and want them.

Details of bathing and of feeding technique are shown. Breast-feeding is an emotional feast as well as an occasion for taking food: when bottle-feeding is necessary the same close contact at feed-times is desirable. Advice is given as to the right clothes to wear in hot weather and also on how to keep children satisfactorily occupied.

The atmosphere in this film is very good. The attention paid to emotional needs is due to the help and advice received from psychiatrists interested in the aims of the film; the wisdom of the producer or sponsor in deciding to draw on this source of help is evident. The treatment of the subject is light, straightforward and unassuming, but very persuasive.

Child care, however, is a very large subject and the treatment here is not comprehensive. Though good as far as it goes, the film tries to deal with rather too much and so is overcrowded with information. It should therefore be seen several times. It is a mistake, too, to dismiss breast-feeding with such perfunctory praise. It is a pedagogic error to show the mother, with whom the audience tends to identify itself, feeding the child in an unacceptable fashion; she should be shown breast-feeding and another mother bottle-feeding.

The colour is good and useful, but the music is unnecessary and the reviewer found it unpleasant. The film is a very useful one for the general public, especially for young parents and those about to enter that category. It should be seen by all doctors, nurses and health visitors working in infant welfare centres and by all medical students and nurses during their training.

*Ronald Mac Keith*

<sup>1</sup> [For review, see *BMB* 956, 957, 958.—Ed.]

<sup>2</sup> [For review, see *BMB* 1093.—Ed.]

1413

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## Mental Health Services

The preceding number of *British Medical Bulletin*, under the general title of Mental Health, endeavoured to cover that field from the psychological and psychiatric points of view. It ranged from the psychiatry of the child, with a discussion on some aspects of juvenile delinquency, to the problems of the mental health of the aged, and included articles on assessment of personality and measurement of intelligence, and surveys of modern trends in psychotherapy in Britain.

This more academic treatment of the subject left no room for any account of those ancillary services which, since about 1930, have been developing and increasing in importance and to which the mental health practitioner has turned more and more as auxiliary aids in rehabilitating and re-integrating the disordered personality of his patient. It is with these services that the present number, under the title of MENTAL HEALTH SERVICES, mainly deals. In addition, in view of the increasing realization of the importance of mental health as opposed to mental disease, the *mens sana in corpore sano*, it was felt that something must be said about the teaching of this subject to medical students and also about the opportunities for postgraduate study now available.

This number, then, opens with an article by Professor Aubrey Lewis on postgraduate study in mental health, in which he traces the history of this subject and shows the considerable advances now in progress, particularly since the radical reorganization of postgraduate instruction in 1944. This is followed by an article from Professor MacCalman on the place of mental health

in the medical curriculum—until quite recently, a very meagre place—in which he illustrates the fact that “a slow revolution has taken place since psychiatric teaching was confined to a few lectures and demonstrations of psychotic disorders”. This revolution is still, one hopes, not yet terminated.

The introduction in 1948 of the new National Health Service which, by the terms of the Act of 1946, is “to secure improvement in the physical and mental health of the people”, has meant integration of the existing mental health services with the new comprehensive Health Service. The administrative and other changes following on this are explained in the article by Dr. Maclay of the Board of Control.

In order to evaluate the services described in the articles which follow, it is necessary to know something of the size of the problem. The latest official figures available, those of the Report of the Ministry of Health for the year ended 31 March 1948, show that the number of persons in England and Wales at the end of 1947 suffering from mental disorder notified as under care was 145,772, of whom 42.8 per cent were male and 57.2 female. A very large proportion, 126,751 or 87 per cent, were certified patients, and 18,585 (12.7 per cent) were voluntary patients. For the single year 1947 the number of direct admissions was 44,356; of these 57.6 per cent were voluntary and 39.0 per cent certified patients.

On the other hand, when we turn to the credit side of the account, we find for the same year that, of direct admissions, the percentage of patients discharged as recovered or relieved was 67.0, while for recoveries alone the percentage was 34.4. It is interesting to note that in 1947 the percentage of total discharges from all causes (including the small number discharged on admission as “not now insane”) was 76.5, compared with an average of only 48.3 per cent for the five years preceding the operation of the Mental Treatment Act, 1930.

These figures would seem to show that there has been considerable improvement in the situation in the last two decades, most of which must be attributed to improved methods of treatment. In that improvement the various ancillary services described in this number have undoubtedly played a not insignificant part. Perhaps the most immediately important service is that of mental nursing. In common with all branches of nursing in the last decade this service has suffered in both the quantity and quality of the recruits offering themselves. It is reassuring to learn from the Chief Medical Officer's Report quoted above that so far this shortage has not been allowed to affect adversely the patients under care. The present position of mental nursing and some indications for future recruitment and training are outlined in the article by Miss Olive Griffith.

Next to nursing come the rehabilitatory services—psychiatric social work, community care and, perhaps most important, occupational therapy. This last has of course been employed for some considerable time, but only in recent years has it become a properly organized and recognized service, and now most mental hospitals employ one or more trained occupational therapists. A very full account of this important form of therapy is given by Miss Macdonald, Principal of the Dorset House School of Occupational Therapy, Oxford, in which she indicates the forms of occupational therapy which have been found most beneficial for different types of patients. It might be remarked that, apart from its therapeutic value, some of the work produced by these patients is of high artistic standard and often of admirable craftsmanship.

The extension of mental health care beyond the confines of the hospital is also a service which has grown only in the last years, but it received a particular impetus in the closing years of the war. Dr. Soddy, in his article on community care, describes the formation of the Ex-Services After-Care Scheme for psychiatric casualties discharged from the Armed Forces and shows how it was gradually extended to the civilian population, while Miss Ruth Darwin gives a short résumé of the development of the psychiatric social workers' service, which had its modest beginnings in 1928, but is now a firmly established and essential part of mental health therapy.

The remaining subject is that of mental defect. It is regretted that it has not been possible to include in this, or in the preceding number of the Bulletin, a paper on the genetical aspect of mental disease. It was the expert view that not enough new research had been done on these lines since previously published work. The education and training, however, of the mentally defective child, though long neglected, are now receiving considerable attention, and Miss Isabel M. Laird contributes an article in which she describes what can be done and is being done to improve the lot of these unfortunate children; although in a sense this must remain only palliative much has been accomplished to help them to optimum development within the limits of their capacity.

Finally, it has been thought useful to include a list of organizations concerned with mental health. Most of these are directly related to the field but others lie on the fringe of sociology—indeed, it is difficult to draw the line. The symposium is concluded by a bibliography of British journals, and of British books published since 1939, devoted to the wide subject of mental health. Short biographical notes on the authors contributing to this symposium will be found immediately following the bibliography.

## POSTGRADUATE STUDY IN MENTAL HEALTH IN BRITAIN

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- 1 Training in psychological medicine before 1914
- 2 Standards set after First World War
- 3 Reorganization of postgraduate training since 1944

It was not until the latter part of the 19th century that psychiatry came to be regarded in Great Britain as a branch of medicine requiring special training; before then it had been assumed that a competent physician could deal with the mentally ill without needing any instruction beyond what he might have received as a medical student. The mentally ill at that time meant the insane; the study and treatment of neurotic illness was not regarded as the concern of the psychiatrist.

### 1. Training in Psychological Medicine before 1914

In 1885 the Medico-Psychological Association instituted a certificate in psychological medicine, open to doctors who had had at least three months' clinical experience in mental disorders or who had attended a course of lectures on insanity and followed the practice of a mental hospital where there was clinical teaching; the examination was in three parts, oral, practical and written. Between 1892 and 1920 this certificate was taken by 370 candidates, who had had no systematic instruction or preparation for it. Gradually, however, it was recognized more and more clearly that this served little purpose, and in 1908 Dr. David Thomson, a prominent member of the Association, pointed out that systematic postgraduate teaching in psychiatry and an examination by the universities and medical colleges were needed. Charles Mercier, then President of the Association, wrote a formal request to the universities and other medical examining bodies, pointing out that:

young medical men, in their appointment as medical officers to asylums, find themselves face to face with work and problems of which they have had no previous knowledge and in preparation for which they can obtain no systematic or scientific training or teaching. As is well known, lectures on psychological medicine and pathological laboratories have been established here and there, and in one or two universities Chairs in Experimental Psychology have been founded; but there is no systematic course of instruction and no recognised diploma at the end of such a course. It is submitted that the time has now arrived when such a course and diploma should be established in the principal medical schools in this country, and a diploma in the subject should be instituted by the examining bodies.

It was also suggested that the minimum period of study should

be one year. By 1912, five universities—Manchester, Leeds, Edinburgh, Cambridge and Durham—had instituted diplomas in psychological medicine, and the Royal College of Physicians, London, had created a special examination in psychiatry. The universities mentioned required candidates to attend a course of instruction. Several universities, including London, permitted the M.D. examination to be taken in psychological medicine, but did not provide special instruction.

The leading psychiatrists of that time agreed, in numerous discussions on the subject, that the unsatisfactory qualities and attainments of a large number of those engaged in mental hospital practice could be bettered, and more-promising recruits attracted to this branch of medicine, if universities would provide thorough postgraduate training, preferably at special clinics similar to those on the Continent, and if the standard of the diploma were kept high. A few of the older psychiatrists maintained, on the contrary, that any such demands upon the intelligence and energy of psychiatrists-to-be would diminish the flow of recruits and make it difficult to staff the "asylums".

### 2. Standards Set after First World War

The First World War altered the situation, and in 1920 Hubert Bond, who had become a Commissioner of the Board of Control, addressed the Association with a plea for schools of psychiatry which would be closely affiliated with general medicine. Less than a score of candidates had taken the diploma, the qualifying courses of instruction had been interrupted and insufficient aid had been afforded by employing authorities in allowing their staff to be seconded for the necessary period of study. Hubert Bond emphasized that any university conducting an examination for the diploma should insist on the student's attendance at a course of instruction given by that university, to ensure that "some important share of the diplomate's knowledge is the fruit of a school of thought with traditions of its own". The lessons taught by the war also led him to insist that clinical experience of the psychoneuroses should be recognized in the curriculum and examination.

Some of the five universities mentioned gradually allowed their courses of instruction, and consequently their diplomas, to lapse. Eventually, although the number of examining bodies remained fairly large, the bulk of candidates in the United Kingdom obtained their diploma from the Conjoint Board for England and Wales or from the University of London, neither of which required candidates to attend a particular course of instruction, though they had to show evidence of clinical work for a specified period in a mental hospital or equivalent institution, as well as in neurology. The diploma in psychiatry of the University of Edinburgh was available only to those who attended a special course of postgraduate instruction at that university. In all the examinations for the diploma, neurology was given a large place in the requirements, and candidates were also required to show an adequate knowledge of psychology and of the normal anatomy and physiology of the nervous system.

Although the majority of psychiatrists who obtained the diploma in psychological medicine during the inter-war period had not been obliged to attend a course of instruction, 600 availed themselves of the systematic instruction, lasting six months, provided at the Maudsley Hospital from 1920 to

1938. The connexion between the Maudsley and the trend of events related above is fairly close. Dr. Thomson's proposals in 1908 were prompted by the announcement of Henry Maudsley's offer to the London County Council of £30,000 for the establishment in London of a hospital which should provide early treatment of mental disease, promote exact scientific research, and serve as an educational institution providing good clinical instruction. The hospital thus created became in 1923 a School of the University of London, providing not only the regular courses of systematic instruction already referred to, but also clinical appointments which served as a training ground comparable to that afforded by the European clinics, particularly the one directed by Kraepelin at Munich. The Royal Hospital in Edinburgh similarly provided postgraduate instruction, in a university atmosphere, for those holding clinical appointments. Bethlem Royal Hospital was admitted as a School of the University of London in 1924, and provided courses of instruction for the Diploma in Psychological Medicine.

The recognition of psychiatry by the universities as an important branch of postgraduate instruction was attested by the creation of Chairs at Edinburgh and at Leeds, and in London where Chairs of Psychiatry and of the Pathology of Mental Disease were created at the Maudsley Hospital. Among the holders of these Chairs have been T. S. Clouston (Edinburgh), Shaw Bolton (Leeds), Edward Mapother and F. L. Golla (London).

Besides the instruction provided at the postgraduate schools in Edinburgh and London, there were two main kinds of psychiatric appointment available: in the psychiatric departments of the voluntary teaching hospitals, and in mental hospitals. The former were on the whole the training ground of psychiatric consultants and teachers, who commonly possessed higher qualifications in medicine, such as the Membership or Fellowship of the Royal College of Physicians, and had had specialized training in neurology and possibly had worked in a university psychiatric clinic abroad. The mental hospital appointments provided training for the bulk of psychiatrists in the various institutions throughout the country; the standards and practice prevailing in these varied so widely that, in some, young men obtained excellent instruction in modern psychiatry, while in others the example and conditions were adverse to good training.

There was also, after the 1914-18 war, a growth of interest in psychopathology and psychotherapy, especially of the neuroses. The Tavistock Clinic was founded by Dr. Crichton Miller and provided opportunities for many doctors and other workers in related fields to gain experience in these branches. The London Clinic of Psycho-Analysis was formed and an Institute developed in association with it which provided a thorough and highly organized training in psychoanalysis. The Institute for the Scientific Treatment of Delinquency was also brought into being. With the help of the Commonwealth Foundation, the London Child Guidance Clinic was set up and afforded training in the psychiatry of childhood to a steady flow of psychiatrists; during this period child psychiatry was commonly regarded as an additional training, to be built on to a solid foundation of adult psychiatry.

For mental deficiency the provision was much the same as for mental disorder; the bulk of those working in institutions for the defective had no other specialized instruction than short courses of lectures and demonstrations given to prepare candidates for the Diploma in Psychological Medicine. The

Diploma of the University of London allowed candidates to profess a "higher knowledge of Mental Deficiency".

### 3. Reorganization of Postgraduate Training since 1944

In 1944 the Interdepartmental Committee on Medical Education put forward its proposals for the radical reorganization of postgraduate instruction. It urged that the award of postgraduate medical diplomas, such as that in psychiatry, should be undertaken by the Royal Medical Colleges and not by the universities. The Interdepartmental Committee held that the postgraduate training and experience of intending psychiatrists should be comparable with the requirements for specialists in other branches of medicine, and that the generally low standard of the diplomas in psychological medicine and the inadequate clinical requirements and experience demanded must be raised appreciably. The training should be of four or five years' duration and should be obtained in approved institutions which, on account of their high standard in staffing and other facilities, were capable of providing the requisite supervision and teaching. The Committee emphasized the special position of Edinburgh and London in this regard.

Detailed proposals regarding the desirable range of clinical training and instruction were put forward by a Royal College of Physicians Committee on Psychological Medicine, of which Sir David Henderson, the Professor of Psychiatry in Edinburgh, was the chairman.

In London the comprehensive scheme for organizing postgraduate schools within a federation led to some radical changes. The Maudsley Hospital Medical School became the Institute of Psychiatry within the University of London, and the post-war years saw a large influx of postgraduate students, the majority of them recently demobilized from the fighting services, who received training by appointment to the established staff or as supernumerary registrars and who attended the systematic courses of instruction planned to cover a minimum period of two years. These courses followed, so far as lectures and demonstrations were concerned, the customary pattern of university teaching, while the clinical instruction was given at the Maudsley Hospital and at associated hospitals. Bethlem Royal Hospital ceased to be a School of the University in 1946, but since July 1948 the Maudsley Hospital and Bethlem Royal Hospital have formed one teaching hospital, in close association with the Institute of Psychiatry.

In Edinburgh, training is centred on the Royal Edinburgh Hospital for Mental and Nervous Disorders and the associated University Department of Psychiatry. Candidates seeking the diploma in psychiatry of the University are required to have spent a year in general hospitals, including six months as a house physician; to have had three years' training in approved psychiatric institutions, including 18 months in a mental hospital, 6 months in neurology, 6 months in child psychiatry and mental deficiency, 3 months in psychology and 3 months in special study; and finally to have attended a 5 weeks' whole-time course at the University during the autumn term immediately prior to the examination.

A number of other universities have either revived or created diplomas in psychological medicine, and have set up corresponding courses of instruction. Among these are Leeds, Bristol and Manchester. Chairs of Psychiatry have been created at Leeds, Durham, Aberdeen, Glasgow and Manchester, and facilities for postgraduate instruction are being actively developed at those universities.

In 1946 the Conjoint Board for England and Wales revised the clinical requirements for candidates taking its diploma in psychological medicine. All candidates must have completed not less than 2½ years' special study of psychological medicine at recognized hospitals or institutions, devoting 6 months to nervous diseases, 18 months to mental diseases, and 6 months to child psychiatry and mental deficiency.

The University of London, which had instituted more exacting clinical requirements in 1936, found it necessary to suspend these and has not yet settled the future requirements which will be demanded from candidates who sit the final examination of the diploma. It has hitherto been an "extension diploma", i.e., a diploma for which candidates do not need to attend any specified course of systematic instruction in the University.

The pattern of postgraduate teaching in psychiatry afforded by the universities varies somewhat. The following list shows the courses given in the Institute of Psychiatry at the Maudsley Hospital :

### FIRST YEAR

#### *First Term*

- Anatomy and physiology, including electrophysiology, in relation to mental disease

#### *Second Term*

- Methods of psychiatric examination
- Elementary statistics
- Mental testing
- Introduction to social investigation and treatment
- Introduction to administration of psychiatric services

#### *Third Term*

- Historical development of modern psychiatry
- Principles of dynamic psychology
- Systematic general psychiatry, including treatment
- General and social psychology, including personality

### SECOND YEAR

#### *First Term*

- Child development
- Child psychiatry (including mental deficiency)
- Administrative procedure and legal relationships
- Social medicine and legislation

#### *Second Term*

- Psychophysical relationships
- Genetics of mental disorder
- Psychiatric aspects of cerebral disease
- Character structure
- Psychotherapy, including occupational therapy
- Analytical psychology (Jung)
- Psychopathology
- Social psychotherapy

#### *Third Term*

- Pathology of the central nervous system, anatomical, biochemical and electrophysiological
- Forensic psychiatry
- Psychiatry and the community
- Criminology

These lectures and demonstrations occupy, in all, some 312 hours in a university session. Specialists in training at the Institute who obtain junior appointments as house physicians or registrars at the Bethlem Royal Hospital and the Maudsley

Hospital are provided with clinical instruction not only in the in-patient and out-patient departments, where the neuroses and psychoses of adults and children can be studied, but also at prisons, remand homes<sup>1</sup> and general hospitals; instruction in neurology is also a necessary part of full clinical training.

The principle followed in the general plan of postgraduate education in this country is that the future psychiatrist should spend five years after he qualifies in gaining adequate knowledge and experience in the various branches of the subject. If he wishes to specialize in any particular division, for instance psychotherapy or neuropathology, he can, in a large centre like the Institute of Psychiatry in London, do so during the latter part of his training. Thus, during the first two years he would in any case attend classes and demonstrations in neuro-anatomy and neuropathology and would probably take part also in fortnightly clinicopathological discussions; in his third year of training, or later, he might concentrate on the study of a neuropathological problem, giving half or even the whole of his time to it for six months or more, according to the nature of the problem and his personal aims in psychiatry. The candidate who wishes to become a psychotherapist might begin a personal analysis at a comparatively early stage of his training and would gradually be given more and more opportunity of treating patients by special psychological methods. The same applies to many other divisions of clinical and scientific psychiatry and related fields such as psychology. Apart from the provision organized by the universities, there are facilities at various hospitals and clinics, such as, in London, the Institute of Psycho-Analysis, the Tavistock Clinic and Institute of Human Relations, the Society of Analytical Psychology, the Cassel Hospital, the Institute of Child Psychology, the Therapeutic Social Club Centre, etc.; at other university centres similar facilities exist, though not on the same scale as in London.

Psychiatric departments at the undergraduate teaching hospitals and at postgraduate hospitals such as the National Hospital for Nervous Diseases, Queen Square, and the Hospital for Sick Children, Great Ormond Street, both in London, further enlarge the field wherein postgraduate training may be obtained. In London the arrangements are centralized through the British Postgraduate Medical Federation, of which the Director is Professor Sir Francis Fraser. Similar but smaller postgraduate organizations exist at each of the other university centres in Great Britain. Overseas physicians who wish to obtain psychiatric experience in Great Britain do so either through the university organization or, in the case of certain scholarship holders, through the British Council and the Nuffield Foundation. The Empire Medical Advisory Bureau also provides facilities for practitioners from overseas.

It will thus be seen that the range of training provided for psychiatrists is wide, and differs according to the branch in which the postgraduate is specially interested. There is much flexibility and experiment in the various centres, which may lead to interesting educational developments.

<sup>1</sup> The primary purpose of remand homes is the custody of children remanded by courts of law or committed for trial.—Ed.



# THE PLACE OF MENTAL HEALTH IN THE MEDICAL CURRICULUM

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- 1 Recent rapid growth of psychological medicine
  - 2 Requisites of a good medical curriculum
  - 3 Methods of teaching
  - 4 Study of the patient as a person
- References

Had this symposium on mental health been written a quarter of a century ago little could have been said about the teaching of psychiatry to medical students. In some medical schools there was no organized course, and, when instruction was given, the student had to be content with a few lectures, supplemented by what was correctly described as a "variety show" at a mental hospital. If the subject was ever mentioned by other clinical teachers, a tone of such criticism and disparagement was used that the student was little encouraged to take an active interest in it. Nor would much have been found in the literature published in this country.

There were, of course, notable exceptions. In 1823 the first systematic instruction in psychiatry was given in Edinburgh by Sir Alexander Morison, and in 1915 the Managers of the Royal Edinburgh Hospital endowed a chair at the University. In the same year, in the USA, we find Adolf Meyer outlining a course for medical students which met with obstruction and indifference at that time but which proved to be strangely prophetic of the best teaching today. The demand for better instruction came not only from inspired teachers like Adolf Meyer but from students themselves. In 1941 the Medical Students' Committee of the National Union of Students submitted a strongly-worded memorandum to the British Medical Association, in which they stated:

In the course of his studies the student is constantly meeting with psychological problems of which he has no understanding and even less knowledge how to treat. It is the opinion of nearly all students that the present arrangements for the teaching of psychology are totally inadequate. In those cases where practical instruction is given there is insufficient use made of the material to be found in the wards and out-patient departments.

This echoed the findings of the American National Committee for Mental Hygiene Conference in 1936 which set as its goal "the stimulating of the student's sense for the personal reaction and problems of the patient in any medical, surgical or obstetrical case, not only in the obviously psychiatric or psychoneurotic patient" (Lief, 1948).

In the last twenty years increasing attention has been paid to the teaching of psychiatry. This is reflected in various important papers and reports. Much prominence, for example, is given to the subject in the British Medical Association's *Report of Committee on Mental Health* (1941) and in the same body's *The training of a doctor* (1948). The same applies to

the more official *Report of the Inter-departmental Committee on Medical Schools* (Ministry of Health & Department of Health for Scotland, 1944)—often referred to as the Good-enough Report—and the General Medical Council's *Recommendations as to the medical curriculum* (1947). Here it is not possible to discuss in detail the interesting recommendations which these reports make but they should be read by anyone who wishes to assess the position which mental health holds today in the medical curriculum in Great Britain. Rather, an attempt will be made to discuss some of the issues and difficulties which these reports raise, and to comment upon possible future developments.

## 1. Recent Rapid Growth of Psychological Medicine

The acceptance of the need to give mental health a more important place in the medical curriculum could not have taken place had there not been a correspondingly great demand for psychiatry on clinical grounds and an increase in psychiatric knowledge. There is abundant evidence of the former, for the need for practical therapy far exceeds the supply of trained personnel. The recent development of psychological medicine has been so rapid that its history reads like the story of Cinderella. From a position of relative isolation from the general body of medicine it has emerged into glittering if uncertain prominence. A mere quarter of a century ago its scope was limited to the study and treatment of the graver forms of mental disease within the geographical remoteness of "lunatic asylums". Now it embraces the psychoneuroses and the so-called psychosomatic disorders; its preventive aspects cover child guidance and delinquency and range over a vast field of social, cultural, industrial, eugenic, educational, military, and even political factors. Even the man in the street has taken it home on approval though he has not yet "bought it".

This rapidly increased demand for psychiatric service has made teaching at the undergraduate stage very difficult, for scarcely enough time is allowed in the course to teach any one aspect adequately. It has had other effects too. Despite the fact that the older psychiatrists have struggled to retain the mental hospital as the main focus and location of therapy and teaching, an increasing number of psychiatrists are therapists in the community based upon the general hospital. Hence the teacher must attempt to bridge the gap between institutional and extramural interests, and orientate himself to a variety of new methods in child guidance and psychoanalysis, social medicine and modern methods of physical treatment. Some teachers obviously have found difficulty in doing so; others, because of the new alliance between medicine and psychiatry, have orientated themselves to the requirements and standards of internal medicine and know more about the patient's nervous system and the various techniques and tests by which it can be measured than they do about the patient as a person. Still others, pointing to the small contribution which neurophysiology makes to the understanding of human behaviour, concentrate upon teaching a psycho-analytic view of life. There are thus few teachers whose background of experience has been sufficiently wide, whose knowledge is sufficiently erudite, who retain an active personal experience in all types of psychiatric practice, and who enjoy and are skilled in teaching. All the reports mentioned above indicate that there is a great shortage of those whose development and abilities have been along these lines, and

give an appropriate warning that considerable time must pass before teachers can be selected who have the requisite experience and skill.

## 2. Requisites of a Department of Psychiatry

The first requirement for the proper provision of training for medical students is that every medical school should have an active department of psychiatry, centred in the teaching hospital and co-ordinated with the work and teaching of the other clinical and non-clinical departments. It is only when the student comes to know the psychiatrist as a familiar figure in the wards, out-patients departments and clinical conferences that he recognizes and accepts the part which psychological medicine has to play in the prevention and treatment of ill-health. The time has passed when psychiatrists had to fight for recognition and position, and so has the need to demand autonomy. Rather, the student should see the bilateral osmosis of knowledge which takes place when the psychiatric department is truly integrated with all other disciplines and therapeutic procedures, and note the enormous gain in the general body of medical skill which results. At the same time the university department of psychiatry must have a close association with the mental health services of the community. Ideally this means a sharing of staff between the mental hospitals, mental deficiency colonies, child guidance clinics, and the statutory activities of the local health authorities. Administratively the provisions of the National Health Service Act make this co-ordination much easier, for in most areas the head of the department plays a prominent part in the work of the Regional Hospital Board. Here, in parenthesis, should be mentioned the burden of administrative duties and activities which the head of the department is expected to carry. Much of his time is taken up by university, teaching hospital and Regional Hospital Board committees, but this complaint can equally well be made by clinicians and teachers in other subjects.

The Goodenough Report (Ministry of Health & Department of Health for Scotland, 1944) gives a broad and helpful outline of other prerequisites of a department of psychiatry, and we can pass on to consider briefly the seldom-mentioned fact that students find psychology and psychiatry difficult to learn. The majority are obviously fascinated by these subjects, but there is ample evidence that they are emotionally disturbed by facing the facts of life which patients so frequently demonstrate. As Whitehorn (1946) says:

There is uneasy laughter, tense silences, fixity of facial expression, often even a flushed and belligerent defense of the polite evasions against the "base insinuations" of the more objectively oriented observer.

It is not surprising that this should be so, for students are generally brought up in "respectable" circles and it is not easy for them to take the risk of disillusionment in the search for truth about themselves and their fellows. Further, they have been trained from an early age in the study of subjects where reliance can be put upon reason and intelligence as instruments in learning, but the facts of psychology demand other qualities for their understanding. The student must therefore face the hard and unpalatable fact that human beings are far from being wholly rational in their behaviour but are very much at the mercy of their emotions in all their actions and attitudes, and that the thoughts they have are determined more by their wishes than by their reason. Partly to overcome this difficulty, and partly in the belief that knowledge of others should be based upon a knowledge of oneself,

Adolf Meyer (1928) introduced his students to the analysis of personality by getting them to chart their own personal history in the making.

In my psychobiology course I begin with the request, "Give the steps of evolution of your own personal attitude with regard to the nature of mind from childhood up and your understanding as to the nature of the facts dealt with under the heading of psychology".

Such a high-sounding demand might, it could be alleged, produce just those culturally-determined and polite evasions of reality which dynamic psychobiology attempts to eradicate. My own experience of students' autobiographical life-charts is that they show an astounding lack of appreciation of the "biographic determinants" which Meyer considered so important. Some method which goes deeper than self-analysis is obviously desirable but I would hesitate to agree with Rado (1946) that "Under ideal conditions, every medical student would be psychoanalyzed, preferably during his (pre-medical) college years". Opportunities should, however, be taken, particularly during clinical demonstrations and seminars with small groups of students, to relate to their own lives and experience the dynamic factors uncovered. Time should also be given to group discussion, which ought to be as far as possible leaderless, and which turns naturally for illustration to autobiographical experiences. Some critics of this type of teaching allege that it is so emotionally disturbing that students may themselves fall mentally ill. It must be obvious, however, that there is already a significant breakdown-rate among medical students and qualified practitioners, and that any method of uncovering, at an early stage, a latent vulnerability is to be welcomed rather than deplored. No method has yet been adopted of eliminating by selection those who would find the brutal and unpalatable facts of medical practice too much for them.

Another difficulty concerns the personality of the teacher himself. An instructor is appointed generally because he has a good knowledge of the subject and a flair for research. It is assumed that he has a liking for teaching, is interested in his subject, and gets on well with students. In actual practice it must be admitted that there are other less worthy motives which divert psychiatrists into the academic field. It is, as Greenacre (1946) points out, quite as true of professors as of the practitioners of psychiatry that their wish to understand and help maladjusted patients has some nuclear need to understand themselves and those near them, and that they have an obligation to face their own neurotic problems. There may be, too, a hidden or even overt wish in the case of the full-time teacher to lead a cloistered life, withdrawn from individual responsibility to patients and from the keen competition with colleagues that he would experience in practice. In the extreme case the teacher, to whom his profession has become too strong a neurotic defence, becomes dogmatic and then disappointed.

Greenacre (1946) also indicates that the relationship between the teacher and the student is of great importance:

That this quasi-fraternal relationship of teacher and student, that benevolence should at least slightly outweigh the tacit competitiveness, basically a sibling rivalry, seems to be imperative for good teaching. For in all teaching relationships, whether the formal ones of school or the informal ones of the family, a good feeling towards the teacher furnishes the necessary emotional background for *assimilation* of knowledge and genuine understanding. This is comparable to the positive relationship between patient and doctor which is the necessary general framework of the complicated and difficult transference reactions in the course of psychoanalysis.

We must admit that this is true in the teaching of psychiatry, where the personality of the teacher tends to become inextricably intermingled with his subject-matter. But what Meyers called "the adoration of personalities" is much in evidence in other fields of medicine, though the negative transference shown by students is clearly not suspected by a number of leading figures in our medical schools. One cannot expect many surgeons, for instance, to show much insight in their relationships with students, but every psychiatric teacher should have in mind the effect which his personality has upon his students. Aubrey Lewis (1947) gives a witty account of a questionnaire designed to assess student opinion. He concludes that "it seems safe to infer from the replies of the 75 students that psychiatry is not now a laughing-stock or a closed book to the bulk of medical students but a serious and on the whole respected branch of medicine". Carefully fostered leaderless group discussions should extend the teacher's self-knowledge and lead to a reformulation of his attitude and methods. Only thus can he learn from his students (who may presently succeed him) and go on to a world of wider experience and knowledge.

### 3. Methods of Teaching

In conclusion something must be said of the methods of teaching which are best adapted to the teaching of undergraduates. Perhaps the first lesson which the teacher must learn is that the student is immature, not only in experience of men and affairs but also in his own emotional development. To give only one simple example: the fact that he is generally unmarried and therefore inexperienced in parenthood makes it hard for him to appreciate the difficulties and diversities of family life. This is particularly true of the student in his pre-clinical period when he may not even realize that there are individual differences in intelligence, personality and character. In many instances the nature of his previous education may have been so materialistic that he unwittingly subscribes to the doctrine of psycho-physical parallelism. Mind and body are to him sharply divisible entities, and he probably considers it somewhat dangerous and certainly not very "good form" to think too deeply about himself or his fellow beings. Added to his ignorance of human nature is probably a surprising lack of acquaintance with literature. One student, when asked what he had read lately, at first looked blank, then, brightening visibly, said with eager pride: "The last book I read was one by Peter Cheyney<sup>1</sup>".

To this immaturity the teacher must adapt himself, conscious that he must use his opportunity to stimulate a curiosity about human nature, a broad and humane attitude to all aspects of ill-health, an understanding and a toleration of human frailty. Following the reiterated precepts of Adolf Meyer, he will avoid abstruse interpretations and theories and direct the student's attention upon facts which are clearly established and connected with his own experience. Particularly in clinical teaching he will demand from the student concentration upon the behaviour, mood, stream of thought, ideas, etc. shown by the patient in his presence. Such training in observation will do much to counteract the student's pre-conception that there is something vague and mysterious, something indeed almost akin to crystal-gazing, about a psychiatric examination.

As far as possible, therefore, the student should learn by

doing. For this reason formal lectures should be kept to a minimum, and should be used mainly to arouse interest, to stimulate curiosity and to foster a thirst for practical knowledge. As the curve of forgetting related to the spoken word falls steeply within a few hours, and as the notes taken by the student are generally confused and illegible even to himself, a crisp résumé should be given in mimeographed form.

Much more use should be made of the tutorial system although it is time-consuming and presupposes that the psychiatric department has a large and experienced staff. But tutorials should not be allowed to take the form of a monologue, even though this may be preferred by the student and easiest for the teacher. One of the great difficulties is that the student has been expected, from his earlier schooldays, to produce accurate knowledge for his teachers and has been made timid of his powers of observation and deduction by the sanctions imposed upon inaccurate answers. Most students are what has been aptly termed "boss-eyed", that is, they constantly try to estimate the mood and wishes of the person in authority and will give textbook information even when they privately disagree with it. Advantage may be taken of the fact that they are also pathetically eager to find a good father-figure, one who will allow them to talk without severe restrictions, who will tolerate their ignorance, and correct their mistakes without sarcasm or malice. Liberal use should be made of what Rickman called the psychiatric silence, the teacher being sufficiently secure in his handling of the group situation not to fill the inevitable pauses in discussion with his words and his ideas. In this way the student learns something of what, after all, is going to be his main clinical skill in the practice of medicine—the interpersonal relationships between himself and his patients, between his patients and the others who make up their occupational, family and community backgrounds. Students show interesting individual differences in their method of handling interpersonal relationships. As may be expected, those who score most in theoretical examinations do not always rate so high in the ease with which they deal with their fellows. This type of discussion-group teaching is therefore also of value in assessing potential clinical skill, and may in the future be used in advising the student as to the branch of medicine in which he is most likely to succeed.

### 4. Study of the Patient as a Person

Ample opportunity should be given to the student for appreciating the importance of environmental, cultural and occupational factors in all types of ill-health. A high proportion of students on qualifying become family physicians. It is strange, therefore, that so little opportunity is given them, in their undergraduate training, of seeing and studying the homes of the patients whom they encounter in hospital. Some indication of the importance of parental and sibling influence on personality development should therefore be given in the pre-clinical course of lectures in normal psychology. This should be amplified and illustrated during the transitional period of study, when the psychiatrist should co-operate with the other clinical teachers by helping the student to study the person who is ill, rather than the disease process from which he suffers. This can best be done when a small group of students co-operates with the teacher in examining the patient's life history in an attempt to answer such questions as: what kind of person is this who has fallen

*Continued at foot of page 191*

<sup>1</sup> A contemporary writer of detective fiction.—Ed.

## OCCUPATIONAL THERAPY AND MENTAL HEALTH

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### A Aims and principles of occupational therapy

### B Methods of fulfilling these aims and principles

- 1 Selection and training of personnel
  - 2 Co-operation with the physician
  - 3 Duties of the occupational therapist
  - 4 Occupational therapy in relation to physical treatment in psychiatry
- References

It is important, in discussing occupational therapy, to emphasize that therapy means treatment, and that treatment presupposes diagnosis, prescription and application by selected and trained personnel. Note the two qualifications mentioned. Though undoubtedly important for all ancillary medical workers, selection and training are particularly important for the occupational therapist. An occupational therapist has to help the patient to help himself, a task far less easy than doing something for him. The success of the treatment is, in the first instance, particularly dependent on the person applying the treatment.

To clarify the subject-matter of this article it is essential to find a definition for "mental health". This, unhappily, is

more difficult than discussing conditions of ill-health. A broad charter for conditions of mental health may be taken from the following, by Nicole (1946):

Perhaps happiness and adaptability are the keynotes to the diagnosis of mental health—it has to be "diagnosed", for it is so uncommon—or else liberty in the broad sense may become the hall-mark of the healthy man. Not liberty that comes from the refusal to recognize obligations, but an internal moral freedom that allows of full use being made of intelligent discrimination. . . . Crichton-Miller would measure man's liberty in terms of his detachment from fear of consequences; that is, fear of frustration (self), fear of retribution (society) and fear of extinction (future).

These fears undermine health: they can be overlaid by, or converted into, physical or psychological symptoms and syndromes, or they can accompany certain conditions of physical or psychological illness. But "the development of . . . positive qualities inevitably eliminates their opposites" (Read, 1944); so occupational therapy is designed to provide these positive qualities and to help to dispel the symptoms of the disabilities for which it is prescribed. "One of the requirements for Mental Health is a task" (Carrington, 1946)—occupational therapy provides that task.

### A. AIMS AND PRINCIPLES OF OCCUPATIONAL THERAPY

The occupations used in this form of treatment cover all forms of work or recreational activity, mental or physical, "medically prescribed and professionally guided to aid a patient in recovery from disease or injury" (Willard & Spackman, 1947). Occupational therapy is not just any work or recreation given to entertain the patient.

In spite of the necessary attention to the disability of the patient, no occupational therapy can hope to succeed unless the patient is treated as a whole individual with proper consideration for his economic, social, psychological and physical needs. Treatment must be part of a well-organized and co-operative scheme of rehabilitation, the occupational therapist having close connexion with other medical workers, such as almoners, nurses and physiotherapists, and with the aim of:

### MENTAL HEALTH: UNDERGRADUATE TEACHING

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ill? how does the illness affect the patient and the patient the illness? what effect have his home and occupational conditions had upon his health and what can usefully be done to ameliorate these conditions? did his early upbringing and circumstances have any bearing upon his present condition? This type of enquiry appeals strongly to the student, who is at last realizing his ambition to deal with real people who are in need of medical care, and becomes more vividly alive to him if he is permitted to visit the patient's home, particularly when he can discuss his findings with the psychiatric social worker. Later in his course the student should have the experience of seeing the co-operation between the departments of social medicine, child health and psychiatry.

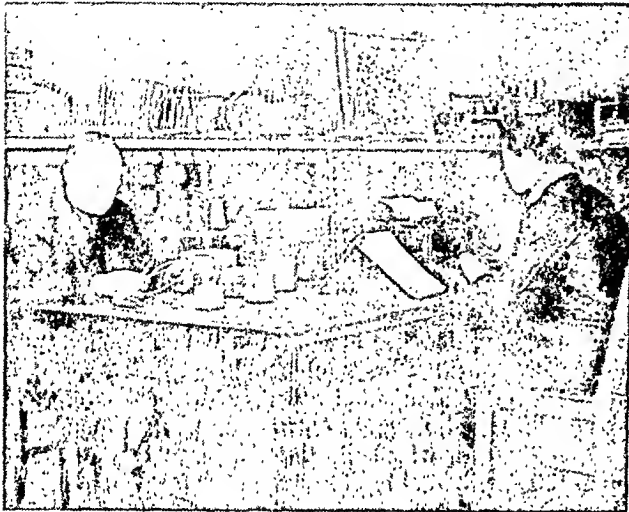
There are many new techniques and methods of teaching psychiatry and many opportunities throughout the medical curriculum

of presenting the patient as a person to the student. Enough has been said, perhaps, to illustrate the fact that a slow revolution has taken place since psychiatric teaching was confined to a few lectures and demonstrations of psychotic disorders. That revolution reflects the changing interests and developing knowledge of psychological medicine, and we may look forward to the time when such knowledge will infiltrate and enlighten all medical teaching. But before that desired end can be reached, much time and patience and determination must be spent by psychiatrists themselves in building up a body of proven knowledge. The defects and failures of present-day teachers and their training must be honestly faced, so that medical students in the future can have the mature, wise and understanding teachers they deserve.

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**FIG. 1. BASKETRY; EDUCATIONAL AND PRE-VOCATIONAL TYPING**

re-establishment of the patient in former employment, or assessment and vocational training for new employment in normal, sheltered or "home-bound" conditions. Employment under "sheltered" conditions indicates the possibility of working and earning under special care and with special provision made for disability. Employment of the "home-bound" means taking work to the disabled in their own homes. These two latter services are being catered for by the Disabled Persons Employment Corporation.

Over-emphasis on the economic factors of the patient's treatment can be as detrimental as neglect of this aspect. It is true that at times the primary need of the patient may be economic re-adjustment. Proper choice of occupation as treatment can, undoubtedly, contribute to this. At other times, distraction from excessive economic anxiety may be the aim.

The maintenance or improvement of social adjustment in illness can lessen the period of sickness, and occupational treatment devised to this end can influence considerably the re-establishment and sense of security of a patient in convalescence and on discharge. A continued link, maintained with patients after discharge, through social clubs or by visits to sheltered workshop or home-bound cases, can sometimes prevent a return of symptoms or the necessity for re-hospitalization.

The main psychological benefits of occupational therapy are its normalizing effects and the contribution it makes towards the prevention of invalidism. It relieves emotional tension, arouses interest and helps to focus attention; it offers an outlet for creative and experimental needs, and can, by its practical demonstration of actual achievement, contribute towards the re-establishment of confidence.

Physically, occupational therapy can be useful in the maintenance of good general physical condition, for the restoration of function of joints and muscles, for contributing towards resistance to fatigue and for the assessment of work tolerance. Some further principles are given by Kidner (1930):

(1) In applying Occupational Therapy, system and precision are as important as in other forms of treatment. (2) The occu-

pation selected should be within the patient's estimated interests and capability. (3) The only reliable measure of treatment is the effect on the patient. Employment in an occupation which would be trivial for the healthy may be attended with benefit to the sick or injured, but standards worthy of entirely normal persons must be maintained for proper mental stimulation. (4) As the patient's strength and capability increase, the type and extent of the occupation should be regulated and graded accordingly.

## **B. METHODS OF FULFILLING THESE AIMS AND PRINCIPLES**

### **1. Selection and Training of Personnel**

Occupational therapy, in its initial stages, and in its introduction to the patient, is a very personal matter. So much depends upon the occupational therapist making an acceptable and somewhat social approach, with a view to discovering the occupation which will be interesting to the patient, as well as progressive and therapeutic. The occupational therapist must be trained in the therapeutic possibilities of a large variety of occupations, and have sufficient accurate and scientific medical knowledge and administrative ability to carry out the prescriptions with intelligence and enterprise, coupled with a capacity for observation and skill in acceptable presentation.

Selection of the right candidate for this work is of paramount importance. It need not be limited to a particular type only: there is room for the pioneer, the plodder, the administrator and the executive; but, fundamentally, the applicants must have the following qualities in common: tact, good judgement, an optimistic outlook, emotional maturity, satisfactory personal integration, a sincere and friendly interest in others, a capacity for enjoyment, a wide background of interests, enterprise, imagination and tolerance, and a reasonable amount of assurance and determination in carrying out treatment.

In most training centres students have lectures and demonstrations in the following theoretical subjects: anatomy and physiology, general medicine and surgery, physical medicine

**FIG. 2. METAL TURNING**



and orthopaedics, psychopathology, psychiatry, department management, book-keeping, etc., and, of course, occupational therapy as applied to physical and psychological conditions. They further learn of the therapeutic possibilities of social activities, art, music, drama, literature, domestic and secretarial subjects, gardening and industrial occupations, and of correspondence courses. Certain crafts are taught with the intention of training the students in versatility, in the use of tools and in constructive methods. Emphasis is also put on ingenuity and capacity to help the patient to "make do and mend". The manual arts are among the occupations most adaptable and readily acceptable to the patients, and give opportunity for objective observation of the patient as an aid to diagnosis and further prescription. Among these manual arts are woodwork, metalwork, textile design and construction, pottery, leatherwork, basket-work, and stool- and chair-seating. (See figs. 1-6.)

During training, students work in hospital rehabilitation departments under trained occupational therapists. There they learn the practical problems of application of treatment by occupation, and of departmental management, and how best to co-operate with other treatment departments.

In the early days the courses were of one year's duration. It has been found, however, that a longer course is necessary to give sufficient basic knowledge from which to work. The course now covers 2½-3 years, for those without previous experience; some students, offering previous training and qualification, may in less time gain the Diploma of the Association of Occupational Therapists; students from all schools in England enter the examination for this Diploma.

## 2. Co-operation with the Physician

The occupational therapist needs from the doctor in charge of the case the fullest co-operation, and a willingness on his part to understand the aims and methods of occupational treatment. The role of the physician, then, falls mainly under five heads, viz.: diagnosis, and the supply of facts relevant to

FIG. 3. WEAVING ON SMALL LOOMS



FIG. 4. SPINNING



the history of the case; prescription of treatment; prognosis; precautions to be observed; and supervision of treatment, up-grading and progression. It is recognized that all medical men are busy. If, therefore, specific information is given when treatment is prescribed, and special times for observations, reports and revision of treatment are arranged, the occupational therapist need not lose valuable time trying to make contact with the doctor, nor need she work without his expressed wishes. It cannot be too strongly emphasized that occupational therapy carried out with the really active supervision and co-operation of the doctor is successful, and can at times even be termed spectacular. Without this co-operation the treatment is, on the whole, wasteful of time, energy and money.

Apart from the actual prescription and the clinical meetings for assessment of the case, which may be given or conducted by the patient's particular doctor, all ancillary medical services should, ideally, work under a co-ordinating and supervising medical officer, who will interpret to his colleagues the possibilities of the various treatments or the difficulties of the team of workers. This medical officer should correlate all treatments for the benefit of the patient and should distinguish between their usefulness. Not every patient needs every form of treatment.

## 3. Duties of the Occupational Therapist

These fall under two main heads, namely, administration and the actual carrying out of treatments.

*Administration*

Before opening his or her department in the hospital or rehabilitation centre, the occupational therapist must make assessments of the following: (i) area to be served by the rehabilitation facilities; (ii) local interests and industries; (iii) types of patients to be treated; (iv) whether the service is for hospital in-patients, out-patients or for home-bound cases, etc.; (v) the number of patients for whom treatment may be required. In addition there should be consideration of social facilities, ancillary services, transport for out-patients, home conditions, and the possibilities for light, productive and remunerative work for suitable cases.

In considering the question of assistance, what would appear a paradox is true: an occupational therapist with an assistant can more than double her usefulness. In addition to the assistance of further experts in treatment, good voluntary or paid help with stores or book-keeping can be a very great asset.

With regard to details of equipment for the department these vary with the needs and possibilities in different hospitals and centres. Their consideration, though important to each individual hospital, is not one on which generalization can be made, and is too detailed for the scope of this article.

*Prescriptive Considerations and Particular Treatments*

Occupational therapy is useful for physical as well as for psychological disabilities. The science of prescribed work can, however, in all cases be termed to some degree psychological. A happy, contented patient is a better patient for the doctor to treat.

All treatment falls into two categories: (i) general treatment, which aims at maintenance of normal work habits, prevention of invalidism, and maintenance of good physical and mental tone; (ii) special treatment, which carries with it the aforementioned obligations, but has, in addition, a particular aim in giving treatment for a particular disability or for restoration of a particular function.

General and special treatment should be carried out in as normal an atmosphere as possible. The lines of general treatment should be laid down in the light of an analysis of the occupations available; certain patients can be assigned to occupations which are at once useful and of therapeutic value. Naturally, the greatest benefit will accrue if these patients are under expert supervision and if regular reports are made on their progress. These patients should be re-assigned to other occupations whenever their progress allows. It is necessary also to cater for their recreational needs.

Special occupational therapy makes a far more direct attack on the pathological reactions of the patient. In any given case, a full description of the patient and of his individual traits is necessary; but it may be feasible to indicate some of the general principles upon which the choice of methods of treatment is based. A distinction may be made between stimulative and sedative treatment, though this distinction is by no means always rigid. Stimulative occupations give large movements, variety, quick results and encouragement; they avoid monotony and hold attention. Sedative occupations may be repetitive; they should give continuous, rhythmic movements, at the same time holding interest and avoiding monotony.

The prescription of occupational therapy is as individualized a matter as is the diagnosis of the patient's illness. However, mental patients requiring occupational therapy do

fall into certain broad groups, and a discussion of these with the appropriate type of therapy may be of value.

The therapy of psychotic and disorientated patients should have as its goals re-socialization, the maintenance of contact with reality, and arrest of deterioration. Occupational therapy should be part of a carefully organized programme for each day; it is more effective when given in groups in pleasant surroundings. The capacity of the patient and the need for precautions must be considered when the programme is arranged. Community singing, exercises to music, relaxation, and work with large movements are all useful in stimulating interest and initiative, penetrating self-absorption and maintaining work habits. Deluded and refractory patients may in some cases take part in these activities with value. With regressed patients, habit training must be a primary aim.

For many depressed patients, work with an element of challenge in it is a help towards overcoming apathy, a sense of guilt and feelings of inadequacy. Exercises are vital, as are social events and group work; some attention, also, to personal appearance may be stimulated by the making of clothes. Gardening, basketry and flat rug weaving may be beneficial.

For excited patients rhythm is essential, and an attempt must be made to hold and improve concentration. Fatigue, already being induced by the state of the patient, should be avoided; the spells of work should be regulated carefully. Gardening, weaving, wool winding and basketry are useful and safe occupations requiring few tools.

For the psychoneurotic patient, certain principles of the aforementioned methods are applicable. This type of patient should be encouraged to start treatment even in bed, and urged to persist in completing one task before proceeding to another. Occupational therapy can take almost any form in the practical or intellectual field that appeals to the patient and that meets his prescriptive needs and maintains a good balance of work and recreation (see figs. 1, 4). When possible, men should do work of a masculine nature, promoting self-esteem (see fig. 2); in other cases, combined work with women (fig. 3) has a socializing value. Art, modelling and pottery have also very valuable therapeutic possibilities. Reports from the occupational therapists to the medical officer in charge of the case may be helpful in the psychiatric treatment of these cases, and all occupational therapy should be planned in the closest co-operation with other medical treatments. Relaxation should be taught, and occupations which induce this are invaluable. They need not be without stimulative content but should bring relief from tension (see figs. 5, 6).

For the mentally deficient case, occupational therapy can make an important contribution, by helping to develop, to the fullest extent, the existent capacities of the patient; and by helping the disturbed and distressed patient to find his level of ability and achievement—this needs a very particular and individual approach. Occupations already mentioned can be used in varying degrees, and the greatest success is achieved by close co-operation with the nursing, maintenance and educational services of the colony, hospital or home.

**4. Occupational Therapy in Relation to Physical Treatment in Psychiatry**

In discussing occupational treatment given to patients during or after physical treatments, it should not be necessary

FIG. 5. MEN'S WORKSHOP IN A MENTAL HOSPITAL

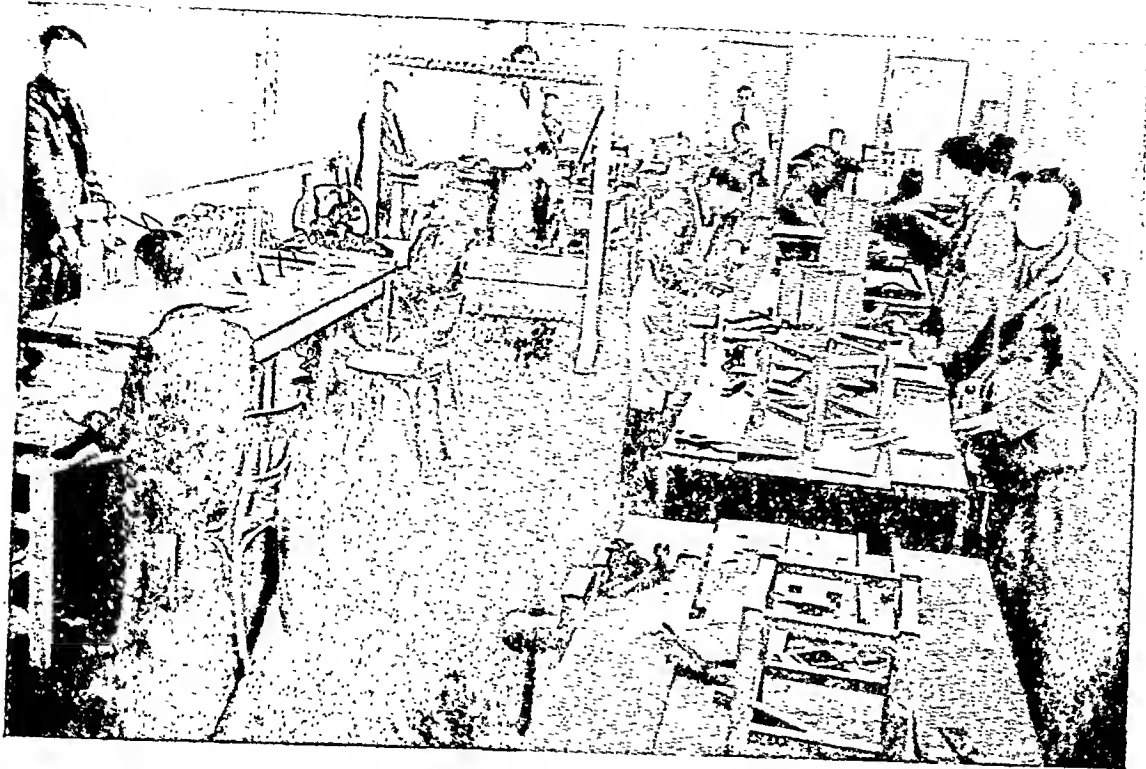
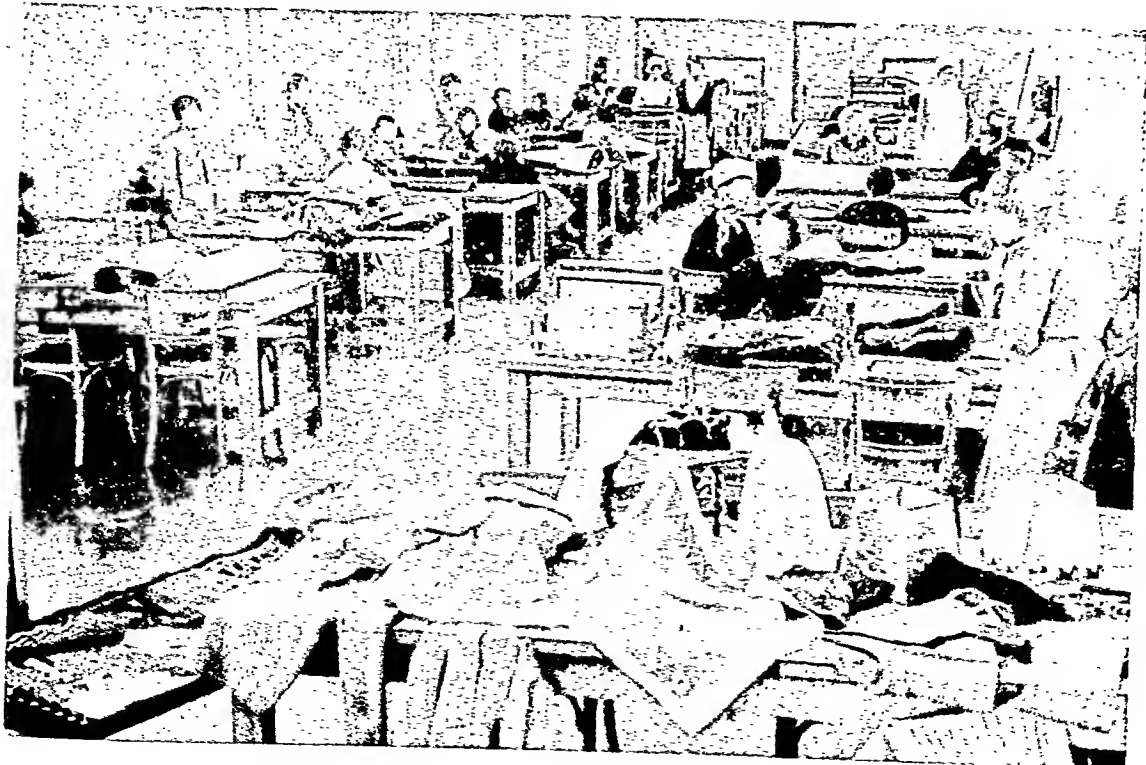


FIG. 6. WOMEN'S WORKSHOP IN A MENTAL HOSPITAL



to enlarge upon or explain the effects of these physical treatments in detail. These will be known to the readers of this article and are discussed in the preceding issue of *British Medical Bulletin* (Hill, 1949). As yet experience of occupational therapy in this field is limited, but a few observations may be of interest.

If the occupational therapist makes contact with the patient before he receives the physical treatment, and if she is able to observe him in at least one of his treatments, she can develop a far more successful programme for him than if he comes only after treatment, as an isolated case of which she has had no previous knowledge; for, according to Sargent & Slater (1948), the make-up of the personality is not in any way changed by physical treatments, except in prefrontal leucotomy. In this latter case it is equally imperative that she have worked with the patient before operation.

Cases receiving *modified* or *deep insulin treatment* will usually receive their occupational treatment in the afternoon. A programme carried out at one hospital arranges the insulin treatment in the morning; after lunch, there is garden occupation for an hour, followed by indoor occupations for 1½ hours. These latter may be of a socializing nature, often in mixed groups, but limited by the physical condition of the patient as well as his psychological state.

Cases receiving *electro-convulsion therapy* should have visited the occupational therapy department on several occasions and become familiar with it before the convulsion treatment is started. Outdoor occupations are good for these patients. The occupational therapists must watch for the first signs of change and improvement in the patient after any one treatment. Advantage of the improvement must be taken immediately and, while the patient is more open to suggestion, further progress can be made towards achieving the highest level of occupation of which the patient is capable.

After *prolonged narcosis*, cases arrive for occupational treatment with visionary disturbances and transitory depression. They have to be given simple, re-assuring occupations within their capacities, though the challenge and quality should be increased with improvement.

Patients receiving treatment by *abreactive techniques* need, above all, to be re-assured and re-socialized in the occu-

pational therapy department; they may be disturbed for days, worrying about what they have divulged to their doctor. It is important that they should meet the occupational therapist as a friend, without suspicion that she may be informed of the facts they have, for therapeutic purposes, been encouraged to reveal to the psychiatrist.

Opinions vary as to when occupational therapy should be started. After *prefrontal leucotomy* it is begun in some cases after 48 hours, in others not till a week later. The patients may now lack some ability and drive, but tension may be lessened, and a form of re-socialization and general occupational therapy is needed. In reporting the results of occupational therapy for the leucotomized patient, Hyde & Wood (1949) state:

There was evidence of increased acceptance of the occupational activities proffered after the operation. Fifteen patients showed increased participation in occupational therapy, 5 were unchanged and 7 showed decreased participation. Ten showed increased socialization, 14 were unchanged and 3 showed decreased socialization. On the other hand, spontaneity was increased in 6, unchanged in 11 and decreased in 10 post lobotomy.

There was a decrease in number of cases displaying self-preoccupation, hostility and compulsiveness and an increase in the number of patients displaying lethargia and malaise. Five patients showed a peculiar defect in their appreciation of the passage of time postoperatively. There was no defect noted in the ability of patients to learn occupational tasks postoperatively.

More could be said of detailed organization and treatment, of the possibilities of the more intellectual occupations, of "psychodrama", of occupational therapy through art, music or industry, but the foregoing information has been directed at giving as complete a general picture of occupational therapy in relation to mental health as is possible within the scope of a single article.

#### ACKNOWLEDGEMENTS

I should like to acknowledge and pay particular tribute to the work and inspiring example of Dr. Elizabeth Casson, psychiatrist and pioneer in the institution of training in occupational therapy in Great Britain.

I am indebted to the following for illustrative material and photographs: Professor Aubrey Lewis, Dr. A. Harris, Miss Olwen Owen, Mr. P. Chappel and Mr. E. Parish of the Maudsley Hospital, London and to Dr. Ström-Olsen of Runwell Hospital, Essex.

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## MENTAL HEALTH AND THE NATIONAL HEALTH SERVICE

W. S. MACLAY *O.B.E. M.D. M.R.C.S. M.R.C.P.*

*Medical Senior Commissioner  
Board of Control*

- 1 Provisions of the National Health Service Act, 1946
- 2 History and development of the central authority
- 3 Responsibilities of the hospital and specialist services
  - a Accommodation for the mentally ill
  - b Care of mental defectives
- 4 Responsibilities of the local health authority

Under the National Health Service Act, 1946,<sup>1</sup> it is recognized clearly that mental health and physical health cannot be separated, and that psychiatry is an integral part of medicine and medicine of psychiatry. The planning of the mental health service is designed to encourage and develop this point of view.

### 1. Provisions of the National Health Service Act, 1946

Under the Act, it is the duty of the Minister of Health

to promote the establishment in England and Wales of a comprehensive health service designed to secure improvement in the physical and mental health of the people of England and Wales and the prevention, diagnosis and treatment of illness . . .

The Act places the responsibility for providing the mental health services on the same authorities as those who are required to establish and maintain comparable services in other fields of health. There are two main divisions of responsibility.

i. *Hospital and specialist service.* The hospital and specialist services are provided by the Minister through the agency of a Regional Hospital Board in each of the fourteen Regional Areas into which England and Wales have been divided for this purpose. The Regional Hospital Board administers the individual hospitals or institutions within its Area by means of a Hospital Management Committee for each hospital or group of hospitals. Each region is based on a university, but the teaching hospitals, though working in close co-operation with the Regional Hospital Boards, are not administered by them but by their own Boards of Governors, directly responsible to the Minister. This is intended to allow the teaching hospital more freedom of action and scope for individuality. This arrangement has been criticized, especially outside London, as leading to needless administrative complications, because Regional Hospital Boards and Boards of Governors have to co-operate in so many projects.

Each Region has a senior administrative Medical Officer and he should have on his staff a Regional Psychiatrist. The

latter post is an important one, as it is to the Regional Psychiatrist that the Mental Health Committee of the Regional Hospital Board turns for help. His job is to act as a liaison officer between the various bodies concerned and to play an important part in the planning of a satisfactory mental health service for the region. The value of such officers, with status second only to that of the senior administrative Medical Officer, is already apparent.

ii. *Local health authority.* The newly constituted local health authorities are responsible, in addition to their other health duties, for certain mental health duties, particularly for the community care of patients suffering from mental defect or mental illness and for the initial care and conveyance to hospitals of patients dealt with under the Lunacy and Mental Treatment Acts. The local health authorities perform their duties through a Mental Health Sub-Committee in accordance with proposals submitted to the Minister and approved by him.

This division of the service between Regional Boards and Boards of Governors on the one hand and local authorities on the other has caused many administrative problems and difficulties, particularly in the field of mental health. It is too early as yet to say whether the advantages of leaving certain duties in the hands of local authorities will outweigh the obvious advantages of having a single service. To give but two examples of the complexities involved: (i) in the field of child guidance the Regional Hospital Board, the school medical service of the local authority, and the local education authority are all interested and must work in harmony; (ii) in the field of mental defect, the local authority is responsible for ascertainment, statutory supervision and guardianship, whereas the Regional Hospital Board is responsible for institutional care and care of patients on licence. It is difficult to get continuity of care unless there is close co-operation between these various bodies.

### 2. History and Development of the Central Authority

The central authority for mental health is the Minister of Health, since he either provides or in some degree controls all forms of mental health service. One of the main problems of legislation and administration in this field is to hold the balance between the treatment of the illness, on the one hand, and the necessity, on the other hand, of infringing the liberty of the patient in cases where detention is necessary for the safety of the patient or of others.

From the earliest times the Lord Chancellor has been concerned with the safeguards for the liberty of the subject, and his participation in the administration of the service is preserved today. Apart from this, the present arrangements can be traced to an Act of 1845, which established a Board of eleven Commissioners in Lunacy as a permanent central authority with supervisory powers. At that date, licences for public asylums were granted under the authority of the Justices of the Peace, assembled in Quarter Sessions. In 1890, the Lunacy Act laid the foundation on which all recent developments have been based. County and county borough councils were charged with the duty of providing asylums, and the Lunacy Commission was established as the central supervisory authority, the Commissioners, both medical and legal, being appointed by the Lord Chancellor. The position was further modified in 1913, when the Mental Deficiency Act

<sup>1</sup> *National Health Service Act, 1946. 9 & 10 Geo. 6, Ch. 81. [1947] His Majesty's Stationery Office, London*



was passed. This created the Board of Control, consisting of Commissioners who took over the functions of the Lunacy Commissioners and who, in addition, were charged with the responsibility for directing the mental deficiency service established by that Act. The Board of Control consisted of Commissioners appointed by Royal Warrant, the legal Commissioners on the recommendation of the Lord Chancellor, the medical Commissioners on the recommendation of the Home Secretary.

It was not until 1920 that the concern of the Minister of Health in this field was recognized. In that year, an Order under the Ministry of Health Act, 1919, transferred to the Minister of Health most of the administrative functions of the Home Secretary relating to lunacy and mental deficiency. The Mental Treatment Act of 1930 marked a further stage in development. The Board of Control was reconstituted to consist of five senior Commissioners appointed by Royal Warrant; of these the chairman, the two medical senior Commissioners, and the woman senior Commissioner are appointed on the recommendation of the Minister of Health, and the legal senior Commissioner on the recommendation of the Lord Chancellor. In addition to the senior Commissioners there are normally eight medical and four legal visiting Commissioners and six inspectors. There are thus some twenty-two individuals to carry out the statutory duties of inspection and visitation throughout the country.

The final changes which established the position and the responsibility of the Minister of Health were made by the National Health Service Act, 1946. There were transferred to the Minister the administrative and medical functions of the Board of Control which, however, retained its responsibilities for dealing with matters affecting the liberty of the subject, e.g. the operation of the safeguards relating to the admission, detention and discharge of patients; and the handling of complaints in regard to conditions and treatment.

While, however, it is possible, on paper, to make this distinction between the administrative functions and functions relating to the liberty of the subject, it is not feasible strictly to maintain it in practice, because frequently both aspects have to be considered in regard to the same patient. In order, therefore, to prevent duplication, and to preserve the accumulated knowledge and experience of those who have been responsible for supervising the service, it has been decided to use the personnel and the staff of the Board of Control for the discharge of the duties transferred to the Minister. These officers were accordingly assigned to the Mental Health Division of the Ministry of Health. They discharge the Ministry of Health functions as officers of the Minister and, at the same time, they discharge the functions retained by the Board of Control in its semi-independent capacity. One of the functions of the Board is to administer directly and without the intervention of the Regional Hospital Boards the State Hospital, for the criminally insane, with accommodation for 800 patients, and the two State Hospitals, for violent and dangerous mental defectives, with accommodation for 1,518 patients.

In addition to the officials of the Ministry of Health and Board of Control, the Minister can call for advice from a Central Health Services Council, which will normally deal with general questions relating to all types of health services, and a standing mental health advisory committee which will advise both the Central Health Services Council and the Minister himself. Of the forty-one members of the Central

Council, two are doctors selected for their knowledge of mental illness and mental defectiveness and two are laymen with experience in mental health services. The standing mental health committee may itself appoint sub-committees so that expert help is available from the widest possible field.

#### *Payment*

All the mental health services are, with unimportant exceptions, to be free of charge to the patient or his relatives, however wealthy they may be. It will be open to Hospital Management Committees of mental hospitals or institutions for defectives to allow patients who do not for medical reasons strictly require a single room, or a bed in a small ward, to have one upon payment of the additional cost thus involved in their maintenance. Such patients will continue to receive medical and nursing attention free of charge. Single rooms or small wards may also be set aside for the patient whose relatives are willing to pay the whole cost, both of his accommodation and of the necessary medical attention and nursing. The charges are to be prescribed by regulation. But neither part-paying nor full-paying patients may occupy rooms or beds which are urgently needed upon medical grounds for non-paying patients. Subject to the foregoing, it will be possible for any member of the medical staff to arrange for his own private patients to be treated in a private room or small ward, either at his own or any other hospital. If he takes advantage of this arrangement, his charges to his patient for his own services must not exceed a maximum which is to be fixed by regulation, and the sum payable by the patient to the hospital for accommodation will not include, as it otherwise would, the cost of those services.

### **3. Responsibilities of the Hospital and Specialist Services**

The two main divisions already referred to, i.e., the hospital and specialist services, and the local authority health service, will now be discussed in more detail.

The Minister is responsible for providing, to such extent as he considers necessary to meet all reasonable requirements:

- i. Hospital accommodation for mentally ill and mentally defective persons;
- ii. Medical, nursing, and other services required at, or for the purposes of, hospitals for mentally ill or mentally defective persons;
- iii. The services of specialists for mentally ill and mentally defective persons whether at a hospital, a health centre, or a clinic, or, if necessary on medical grounds, at the home of the patient.

#### *a. Accommodation for the Mentally Ill*

In the past there have been four main types of accommodation for the mentally ill. The figures for 1947 show their relative importance as regards the number of patients accommodated:

In mental hospitals provided by local authorities . . . . .	128,579 patients
In registered hospitals . . . . .	2,447 "
In licensed houses . . . . .	2,529 "
In public assistance institutions . . . . .	9,507 "

The 101 mental hospitals which were owned and administered by the local authorities have all been taken over by the National Health Service; the 13 registered hospitals, which were non-profit-making hospitals comparable to voluntary

general hospitals, have also been taken over with the exception of four; the 35 licensed houses which are profit-making establishments under private ownership remain outside the National Health Service; the public assistance institutions require rather fuller explanation. These institutions were intended, under the Poor Law, for all types of destitute persons; however, owing to lack of accommodation elsewhere, they have had to look after some 10,000 persons of unsound mind, together with a similar number of mental defectives and a considerable number of mentally-enfeebled old persons requiring hospital care. As a result of the National Health Service Act, public assistance institutions as such no longer exist legally and they have been shared between the health service and the local authorities. If they belong to the health service they are now hospitals and some may be designated as mental hospitals or mental deficiency institutions, or as premises ancillary to existing hospitals and institutions. Such accommodation may prove to be very suitable for the care of the quiet type of senile patient who needs psychiatric supervision, but not necessarily in a mental hospital.

Special mention must be made of what are known as "observation wards", though they have not been included under the types of accommodation mentioned and the term is not to be found in the Lunacy and Mental Treatment Acts. Broadly speaking, the usual procedure for certification prescribed by the Lunacy Act, 1890, is that a person of unsound mind who is not under proper care and control shall be seen by a Justice who has at his disposal the petition and appropriate medical documents. This Justice will make the order authorizing detention. The Acts, however, do authorize, in certain circumstances, detention of persons alleged to be of unsound mind, as a temporary measure pending such further proceedings as are required. The maximum period for which a patient can be detained without the intervention of a Justice is 17 days. In some places, e.g. London, it has been the custom for practically all persons requiring care under the Lunacy Act to be removed in the first instance to a ward for observation and detained there until proceedings under the Act are completed. These observation wards may be situated either in a general hospital or in a mental hospital. They deal with a wide variety of acute cases, and large numbers are able to go home within 17 days and thus avoid the stigma of having been certified as persons of unsound mind. The number of hospitals in England and Wales which have observation wards and are able to admit patients under this section of the Act is 128.

The new service is based largely on the mental hospitals—not the old type of isolated unit interested only in its intramural activities, but on hospitals which may have old buildings but which will have a new outlook about their function and will recognize that their extramural duties among the community are just as important as, or even more important than, the intramural.

The following summarizes some aspects of the work to be done by the hospital and specialist service.

#### *Domiciliary*

Persons suffering from mental illness normally receive domiciliary treatment in the first instance from the general practitioner. The services of psychiatric specialists are usually obtained through attendance at in-patient and out-patient departments of the hospital services. If the patient

is unable to visit a hospital or clinic the general practitioner in attendance is now able to ask for expert psychiatric advice to be given in the home of the patient. Arrangements for this purpose are usually made directly with the local hospitals which provide psychiatric services, so that if the patient later attends an out-patient department, or is admitted to hospital, continuity of contact and treatment is possible.

#### *Out-Patient Work*

An adequate out-patient service is essential for securing the early treatment of mental disorders. It is hoped that, in time, the out-patient departments of all general hospitals will, as a matter of course, include psychiatric clinics, as many already do. Only exceptionally need they be sited in separate buildings or in mental hospitals. In a large centre the clinic should be an all-purpose unit, able to deal efficiently with all aspects of out-patient work. Smaller clinics, which may be affiliated to the central clinic, will also be required, but their field of work should be limited, so that they can do better work within these limits instead of trying to contend with every type of problem. Owing to the rapid development of out-patient departments since 1930 there are many which operate only once a week or once a month, and which may be attended by one senior medical officer without any help. The usefulness of such clinics is very limited, as the medical officer is quite unable to deal with the numbers of new and old patients that he has to see and with the variety of problems that may arise. With increased medical personnel at the mental hospitals it is expected that there will be many more doctors available to help in out-patient work and that all those joining the service will within a short time take part, under supervision, in extramural work. The functions of an out-patient clinic are to diagnose the psychiatric disorder, to arrange proper in-patient or out-patient treatment, and to interpret the disorder to persons or agencies who must co-operate in treatment. To achieve this are required adequate premises and an adequate staff of psychiatrists, psychologists, social workers, nurses, technicians and clerks. Although there are now about 250 psychiatric clinics for adults, it can be said that both premises and staff are inadequate in most; in particular there is a lack of psychiatric social workers. If a clinic is to be an all-purpose one there should be specialization within it, to deal efficiently with the various aspects of the work, such as child psychiatry, court work, industrial problems, vocational guidance, teaching, information and research. To take but two of these aspects: (i) The new Criminal Justice Act widens the possibilities of arranging psychiatric examination and treatment of offenders. The courts now have the power to place offenders under a probation order, making it a condition of probation that the offender will agree to go for treatment to a mental hospital, out-patient clinic or anywhere suitable for the purpose of treatment; this will lead to a greater demand on the clinics. (ii) The Ministry of Labour is planning with the Ministry of Health to get from the clinics more psychiatric advice for the employment exchanges when these have to deal with problems of persons with psychiatric symptoms. The main reason for this is that the Disabled Persons Act of 1944 imposes on the Ministry of Labour a duty to help to find or even provide employment for those who are "substantially handicapped for employment by reason of injury, disease, or congenital deformity". This definition includes mental illness and mental defectiveness, and the special officers of the Ministry of Labour, called Disablement

Rehabilitation Officers, are more and more seeking from the clinics the psychiatric advice they need.

#### *In-Patients' Accommodation*

This will be provided in a variety of places.

i. *General hospitals.* For patients without behaviour difficulties beds may be provided in general or in special wards in a general hospital. These beds are intended to serve the patients who require only a short term of treatment away from their homes or for whom investigation is necessary for diagnostic purposes.

ii. *Neurosis centres.* These centres have emerged as the result of war-time developments under the Emergency Medical Service. They are as yet few in number and no general policy in regard to size, administration, etc., has been laid down. In some regions there are independent neurosis hospitals, in others they are under the curtilage of the mental hospitals, while in still others they are linked with general hospitals. They are intended for patients who can be received as voluntary patients under the Mental Treatment Act or without any formality at all. They provide facilities for rehabilitation and psychotherapy fuller than would normally be available in a general hospital, but avoid the necessity—still feared by so many—of entering a mental hospital.

iii. *Teaching psychiatric units.* These are being set up in university centres and are primarily for undergraduate and postgraduate teaching and for research in psychiatry. It is considered that a unit of 60 beds or more is required to provide a sufficient variety of patients. Such units may admit three classes of patients: those admitted without any formality, those who have signed an undertaking agreeing to admission as "voluntary patients" and those who are detained as "temporary patients". At present certified patients cannot be admitted to these units. This may not be such a drawback as it seems, as it has always been hoped that professors of psychiatry would take an active interest in the mental hospitals in their region and be given facilities for teaching in them. Inability to admit certified patients to their own units may help to bring this about.

iv. *Mental hospitals.*<sup>2</sup> Voluntary, temporary and certified patients may all be admitted. The average number of beds required is 3.5 to 4 per 1,000 of the population. Most mental hospitals are of such a size as to require their own Management Committee, but in some Regions the desire to integrate psychiatry with medicine has led to the grouping of mental hospitals with other types of hospital, giving to each of the constituent hospitals a Sub-Committee (called a House Committee) of the Management Committee. The danger lies in the possible development of a three-tier system (Regional Hospital Board, Hospital Management Committee, House Committee), with subordination of the needs of the mental hospital to the demands of the others, as has happened so often in the past. Experience suggests that, although integration is desirable, the integration and interchange of medical and nursing staff is to be preferred to that of the administrative committees.

The question of how far the function of particular mental hospitals should be specialized remains debatable, but there

are obvious advantages in concentrating in hospitals with specially equipped units patients requiring neurosurgical operations such as prefrontal leucotomy, patients with active tuberculosis, and typhoid carriers. To some extent this has already been done in hospitals under large authorities such as the London County Council, but it will now be possible to develop the principle further on a regional basis.

In regard to the voluntary treatment which has been mentioned, it may be of interest to note that, until the passage of the Mental Treatment Act in 1930, patients could be admitted to public mental hospitals only after certification as persons of unsound mind. The Act empowered authorities to admit patients on a voluntary basis, i.e., patients enter the hospital of their own free will and they are free to leave the hospital if they give 72 hours' notice to the medical superintendent. The number admitted in this way has increased steadily each year until the present time, when over 50 per cent of all admissions throughout the country are on a voluntary basis. This and the establishment of out-patient clinics has given a great impetus to the development of early treatment and has led to a greater awareness by the public that a mental hospital is a place where effective treatment can be given and where conditions in a great many instances are fully acceptable to those seeking treatment.

v. *Former public assistance institutions.* Reference has already been made to this accommodation and to its possible use for elderly chronic harmless certified patients or for mentally-enfeebled, aged people who are not certified.

#### *b. Care of Mental Defectives*

There are two principal ways in which certifiable mental defectives can be given the protection they need: by treatment in an institution; by provision of community care through statutory supervision or by guardianship.

The first is the responsibility of the hospital and specialist service, the second is that of the local health authority. The relative numbers in 1947 were:

In institutions provided under the Mental Deficiency Act	53,361
Under guardianship	5,172
Under statutory supervision	43,272

(Guardianship is a method by which the local health authority can put a defective in a private family and pay for maintenance, clothing, etc., if he is unable to earn anything towards these expenses. Statutory supervision is used when there is no need to remove a defective from his home. It provides regular visitation to ensure that conditions are as satisfactory as possible.)

Most of the in-patient accommodation has passed under the control of the Minister of Health, with the exception of some 22 institutions (holding, approximately, 2,000 patients), which were not taken over, mainly because they belonged to Roman Catholic or other religious bodies. Throughout the country there is overcrowding in the institutions and large numbers are awaiting admission. The hardship caused by inability to remove even low-grade defectives from their homes is great, and provision of adequate accommodation for defectives at the earliest possible moment is one of the important tasks of the hospital and specialist services. Many building schemes are ready and only await withdrawal of present post-war restrictions.

<sup>2</sup> The law relating to temporary treatment in mental hospitals is discussed by Mr. Cyril F. Penton in the previous number of *British Medical Bulletin* (Vol. 6, No. 1-2, p. 59, *BMJ* 1305).—Ed.

#### 4. Responsibilities of the Local Health Authority

The local health authority, according to the *Provisions relating to the Mental Health Services*,<sup>3</sup> "is the body responsible for providing the local government health services, as distinct from the general practitioner services and the hospital and specialist services". These provisions define the responsibilities of the local health authority in relation to mental health as follows:

(a) The initial care and removal to hospital of persons who are dealt with under the Lunacy and Mental Treatment Acts.

(b) The ascertainment and (where necessary) removal to institutions of mental defectives and the supervision, guardianship, training and occupation of those in the community.

(c) The preventive care and after care of all types of patient so far as this is not otherwise provided for.

Each local health authority must appoint a statutory Health Committee and normally it is a Mental Health Subcommittee of this Committee which has responsibility for the services outlined above. It is clear that the local health authority has a big responsibility in regard to the prevention and early treatment of mental illness.

Mental health is a positive condition and the task has been placed on the local authority to try to maintain and enhance mental health in the community. It will be necessary to disseminate information regarding mental health services to enable the public to know the resources available and to encourage the early seeking of advice. The schemes prepared by the local health authorities as required by the National Health Service Act show, as one might expect, varying degrees of awareness of their responsibility and a wide variety of methods; comparison of these will, in time, give guidance as to which are the best. Some authorities have asked the Regional Hospital Boards to provide psychiatric specialists to help with, and advise on, their mental health work. This method is obviously a useful one for bringing about a close liaison between the two fields of work. Others propose to appoint their own psychiatrists. Clearly, joint use of the same officer has many advantages, particularly in the complicated field of child guidance.

For some years attempts have been made to clarify the

administrative relationship between the psychiatrist and the educational psychologist or, in other words, the relationship of the health department to the education department. Much of the child guidance work undertaken by local education authorities is an educational service closely linked with the school and the home. Thus the needs of many children who are maladjusted, whether to a degree which calls for their ascertainment as handicapped pupils or to a lesser degree, can be met by social and educational adjustments. Much of the work is carried out at the schools by educational psychologists and specially qualified social workers, in co-operation with parents and teachers. The educational, physical and psychiatric aspects of the work are, however, inseparable, and at the child guidance centres established by the local authorities the team of workers includes a psychiatrist and also, as a rule, a paediatrician. Some of the children will be found to need psychiatric treatment, and the Minister of Health, in agreement with the Minister of Education, considers that these children are the responsibility of the National Health Service and should be dealt with in the child guidance clinics provided by the Regional Hospital Boards. In order to avoid splitting the service it is hoped that there will be joint use of both staff and premises as often as possible. Such arrangements have already been made in many places, so that the child guidance centre under the local education authority and the child guidance clinic under the Regional Hospital Board act as one, with the same premises and staff but with financial adjustments.

In this article an attempt has been made to describe the administrative structure of the mental health services and to indicate to some extent how they may develop. The 1946 Act opens up new prospects, but it will not be easy to translate its provisions from paper to reality. There is too much to do and there are too few to do it. The mental health of the community must be maintained and improved, early treatment must be encouraged in out-patient departments and hospitals, and the care of the chronic patient and of the aged must be improved. Vision in planning, as well as more buildings and trained personnel, will be needed if there is to be an adequate, organized service integrated with other branches of medicine, yet remaining aware of its own particular problems.

<sup>3</sup> Ministry of Health (1948) *National Health Service Act, 1946. Provisions relating to the Mental Health Services*. His Majesty's Stationery Office, London.

## SOCIAL WORK AND SOCIAL WORKERS IN THE MENTAL HEALTH SERVICES

RUTH DARWIN C.B.E.

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- 1 Social care of the mentally disordered
- 2 Care of the mentally defective
- 3 Administration under the National Health Service Act, 1946
- 4 Training and qualifications of social workers
- 5 Future trends

The field of social work in mental health is a wide one and difficult to define; in effect, all social workers are to some degree concerned with mental health problems, and all need knowledge of human beings and human relationships as well as of social and economic conditions. In this article, however, discussion will be confined to the functions and training of those social workers employed under medical direction in the field of psychological medicine. Today this field is vigorously growing, and is certain of progress as a branch of social medicine, but in some respects the lines of future development are uncertain.

The immediate concern of this type of social worker is the care of those children and adults whose behaviour in the community is symptomatic of neurosis, psychological disturbance or disorder, or of mental defect. At the outset, it will clear the ground to classify the cases into two groups: those suffering from mental disorder, and those who are mentally defective.

### 1. Social Care of the Mentally Disordered

This group is a diverse one, ranging from the mentally unbalanced child, whose behaviour may be due to environmental causes, to the patient from a mental hospital still "under certificate" but living in the community. Many persons, not under psychiatric care, come to the notice of the psychiatric social worker because their behaviour gives rise to anxiety. Mothers attending maternity and child welfare centres whose babies show some difficulty in behaviour or development may be referred by the physician in charge to a social worker for home investigation. This may include observation of the mother's emotional attitude to the child, which may lie at the root of the trouble and need modification before the child's own difficulties can be resolved. In the case of children of school age suffering from educational or behaviour defects, home investigation and contact with parents may also be required. The family and social background of juvenile delinquents must also be studied, as well as their inherent mental abilities and abnormalities. Patients suffering

from neurotic and psychopathic disabilities may be referred to the psychiatric social worker by other social workers or agencies; ex-Service men and women often require help in meeting the problems of re-adjustment to civil life; employment agencies, welfare officers in factories, and general practitioners bring forward other cases. The role of the psychiatric social worker is to supply background information so that the position may be clarified and specialist medical advice secured if necessary. Finally, an increasing number of parents, relatives, and friends, as well as patients themselves, are now calling directly upon the mental health worker for help and advice. Preventive work of this kind is recognized as part of the health service of the country; it can be carried out only by social workers who are in close contact with the home and who are aware of the psychological issues involved.

In the psychiatric care of patients at out-patient clinics, the psychiatric social worker is one of a team consisting usually of psychiatrist, psychologist and social worker. She is required to form contacts with the patients and their homes, and acts as a liaison officer between the community and the clinic. In child guidance clinics her role is similar. The psychiatric social worker frequently persuades new patients to come to the clinic for help and advice; she is better able to do this if she herself is in attendance and can effect the introduction.

The services of the psychiatric social worker are called for when a patient is discharged or sent on leave from a mental hospital and, in the opinion of the medical superintendent, requires after-care. Her work here may consist of general rehabilitation in the community as well as adjustment of the patient's relationship with his family, his surroundings, and his employment. Preparing the way for the return to family life before a patient is discharged or sent out on trial is a further function needing skill and judgement; so also is the after-care given during the difficult stage of convalescence. Both these functions and the choice of guardians for homeless patients fit to live in sheltered conditions in the community are undertaken at the request of and in co-operation with a psychiatrist whose work is centred on a mental hospital or clinic.

The statutory duties in relation to the certification of patients under the Lunacy and Mental Treatment Acts, hitherto carried out by Poor Law officials, are now undertaken by officers authorized under the National Health Service Act, 1946; the great majority of these will be social workers. It is still too early to judge the results of this new provision, but there are obvious arguments in its favour.

### 2. Care of the Mentally Defective

The local health authorities are required to ascertain what persons living in the area are mentally defective and to provide care for them; social workers are mainly concerned with this ascertainment and with community care. Ascertainment consists of obtaining a medical opinion on the patient's mental condition and deciding whether he is "subject to be dealt with" under the Mental Deficiency Acts. The medical officer and the Mental Health Committee must depend largely on the social worker's knowledge of the defective's environment and behaviour in assessing need for care, training, or control. Local education authorities report the majority of mental defectives to the local health authorities. Others are referred by the courts, by the police, or by other agents, or



are brought by parents and friends because of behaviour difficulties. Ascertainment is the first step in forming a relationship between the social worker and the defective and his family; this may be continued over very long periods.

Defectives not requiring institutional care are usually referred to the social worker by the medical officer of health for supervision. They may be placed under guardianship if financial help or statutory control is needed. Relevant changes in the behaviour and circumstances of the defective are reported by the social worker. Effective supervision depends upon the social worker's relationship with the family; parents usually have to shoulder the full responsibility for their defective children and need the help which an experienced social worker can give. The social worker helps in finding suitable work, in the operation of recreational clubs, in protecting the defectives from their own weaknesses and from unfair treatment, and in securing training for children who have been rejected by the ordinary schools. Home training may be combined with supervision, and where attendance at an occupational centre is not practicable, the worker should be able to undertake the training of children singly or in groups, and to advise parents how to carry out instruction at home.

Mental defectives sent out on licence at the instance of the medical superintendent and the hospital management committee are referred to a social worker for supervision; they may be high- or low-grade patients, sometimes under care in their own homes but often living with an employer or a foster parent. Many are able to earn their own living and are looking forward to discharge; the period of re-adjustment to ordinary life is a critical one, and it is only by constant watchfulness on the part of the social worker that the inevitable ups and downs of rehabilitation are tided over. The duties of a petitioning officer in obtaining an order when a defective is sent to an institution or placed under guardianship under the Mental Deficiency Acts are often combined with those of a social worker.

### 3. Administration under the National Health Service Act, 1946

Following the pattern of this Act, an administrative division must now be made between those social services supplied by local health and local education authorities, and social work in connexion with the medical specialist services in hospitals, out-patient clinics, and neurosis centres. It must be emphasized that clinically the work is, of course, the same. The same qualifications are needed by workers in both services, and in most areas the local health authorities and Regional Hospital Boards are trying to co-ordinate the work by making joint use of the meagre supply of trained social workers at present available.<sup>1</sup>

The care of mental defectives, and the preventive supervision and the after-care of all types of mental patients, are responsibilities of the local health authority. These duties are usually delegated to a mental health sub-committee of the health committee and the work is carried out by a team of mental health workers under the direction of the medical officer of health. Hospitals, institutions and clinics are provided by the new Regional Hospital Boards and administered

by hospital management committees. Social workers are employed on the staff of mental hospitals and mental deficiency institutions; they also form part of the team employed in adult out-patient clinics and child guidance clinics and centres. There is considerable overlapping between the local health authorities and the hospital management committees, and this can be adjusted only by agreement between the two bodies; these can also delegate social work to voluntary bodies, such as the National Association for Mental Health, employing trained social workers.

### 4. Training and Qualifications of Social Workers

A committee appointed by the Minister of Health is at present considering the question of recruitment, training and qualifications of psychiatric social workers.<sup>2</sup> At the moment the only professional training for psychiatric social workers consists of a university course of one year in mental health, taken by those holding a social study diploma or other suitable educational qualification. The profession dates from 1928; at the beginning of 1948 there were some 300 trained psychiatric social workers. Of these, 93 were known to be working in mental hospitals and out-patient clinics, 94 in child guidance clinics or centres, 35 in other branches of mental health work and 33 in general social work, including administrative and university teaching posts.

Apart from the mental health course there is no standardized training for work with mental defectives, and employees of local health authorities and of mental welfare associations are therefore not equally equipped for their work. Many have reached a high professional standard of efficiency through practical experience and their own efforts, supplemented by short courses organized by the National Association for Mental Health; others, however, have remained in isolated positions without being given any opportunity for training.

The mental health courses at the Universities of London, Edinburgh and Manchester are planned to meet the needs of trained social workers wishing to specialize in mental health work and are supervised throughout by experienced psychiatrists and psychiatric social workers.

### 5. Future Trends

Increasing emphasis on prevention is a feature of the present-day development of the mental health services. Twenty years ago psychiatric social workers were employed in taking social histories in clinics and hospitals, and in boarding out patients: the work has now grown to a wider service of care in the community and is actively concerned with prevention as well as after-care. As a specialist, the mental health worker still takes her place in the team of psychiatrist, psychologist, and social worker. But in the capacity of an educationalist, and as a consultant to other social workers needing specialist advice, her services are extending in ever widening circles. At the same time other branches of social and educational work are feeling the need for increased psychological knowledge; it may be hoped that this will lead to the common basis of understanding needed by all social workers in attempting to relate human beings and their behaviour to their social and economic background.

<sup>1</sup> *British Medical Journal* (1949) 1, 628, Mental health workers in conference. First experiences of new legislation.

<sup>2</sup> *Public Health* (1949) 62, 148, Mental health social work.

## THE EDUCATION OF MENTALLY DEFECTIVE CHILDREN

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- 1 Education of higher grade defectives
  - 2 Training of low-grade defectives
  - 3 Function of the occupation centre
  - 4 Institutional care
  - 5 Value of special measures
- Select bibliography

The term "mentally defective children" will here be used descriptively to include girls and boys up to sixteen years of age whose capacity for benefiting by ordinary education is deficient by at least one-quarter, but by not more than two-thirds. At four years of age the defective child is mentally not yet three, at eight years of age mentally not six, at sixteen and thereafter mentally not over twelve years. This represents the upper limit: at the lower limit of the group will be children whose all-round mental capacity at four will be only one year and four months, at eight only two years and eight months, at sixteen and afterwards only five years and four months. However, no experienced worker would claim that available psychological tests allow such a rigid classification of feeble-minded and imbecile children. Further, practically all defective children, like most people, live at well below capacity level.

It should be noted, too, that the educational handicap must be primarily due to fundamental defect of intelligence, though it may be accompanied in some cases by physical illness, grossly impaired sight or hearing, personality disturbance, or sheer lack of normal opportunity for social development. The defect will persist throughout life, though in favourable circumstances the adult may, for many years after adolescence, show improvement in the use he can make of the skills and information acquired in youth and childhood. The group under discussion, in short, excludes at one end those who are merely backward or dull, and at the other those who are idiots or who border upon idiocy.

There are two points which should be made clear. First, there is still widespread confusion between the terms "mental deficiency" and "mental disease". The defective is not insane, though an occasional defective may become mentally ill in addition to his defect. Second, though the level of general intelligence is an important criterion in the educational placing of very backward children, in the case of certain high-grade defectives it may well take second place to social maturity rating or stability of temperament. High-grade unstable defectives usually require institutional care; whatever other therapy is given, educational facilities suitably adapted to the interests and intellectual level must be provided.

By education is meant any process of "educing" the skills, interests, and capacities each child may have, and assisting him to find a niche in the community life he shares. This education includes actual teaching of much that is taught normal children of similar mental age; much, especially in manners and behaviour, that belongs to children of similar physical age; and much, notably in the first five or six years of life, that average children absorb from the spontaneous interplay of environment and ripening interest.

### 1. Education of Higher Grade Defectives

In schoolwork, reading and writing will have a place, but not a compulsory place: these subjects should be pursued only where there is interest on the pupil's part and where the teacher believes that reading will be a likely hobby after schooldays, or where success will ensure later freedom from illiteracy ratings. Similarly, arithmetic should be restricted to the most practical types of counting, dealing with everyday weights and measures, handling money, and keeping score at games. Instruction in physical education and personal hygiene, lessons in general knowledge and music, the telling of stories, and activities such as gardening and craftwork can be adapted to the ages and abilities of the mentally handicapped. Teachers in charge of such classes should have special initial training, in addition to basic training in teaching, and benefit greatly by having refresher courses from time to time.

Older high-grade defectives should have pre-trade help, both in advice about employment and in practical classes for teaching the necessary skills. Some former pupils of "special schools"<sup>1</sup> will qualify for registration as disabled persons needing special training, or for sheltered conditions of employment. In less densely populated areas the pupils may have to travel to centralized classes; but in rural districts many are adequately catered for by the versatility of the local schoolteacher, and by the willingness of village folk to supervise and encourage the less able ones in their midst.

### 2. Training of Low-Grade Defectives

Mentally defective children are frequently thought of as ineducable. This is a negative description, and incorrect, unless education is thought of as only a matter of book-learning. But education includes more than this, and though deeply handicapped children may not be able to benefit from books, they are trainable and can master many things, including themselves, with surprising success in the right circumstances. Among happy imbecile children the range of individual differences is hardly less marked, to the casual view, than among normal children.

Training may be accomplished in three ways: at home, in centres and in institutions. Where the family, and especially the mother, can accept the defectiveness, the child can often be well cared for at home. Simple household tasks can provide a great variety of occupations which offer interest, exercise, opportunity for the increase of vocabulary, and a sense of usefulness and "belonging" which helps towards more mature behaviour. Such co-operation between mother and child slows down the work of the household of course,

<sup>1</sup> "Special schools" as defined by the Education Act, 1944, are "schools which are specially organised for the purpose of providing special educational treatment for pupils requiring such treatment and are approved by the Minister [of Education] . . ."—*Ed.*

but the time invested is worth-while. The defective child needs the company of his own kind, even at home; a family with a similar child should be sought for exchange visits, and in time, perhaps, exchange holidays. Attendance at a centre may be better still.

Wherever possible home care should be supplemented by home teaching; this provides for visits by the teacher fortnightly, weekly or oftener, and usually a parent, grandparent or sibling will help the pupil between visits. Home teaching may be a substitute for attendance at a centre; organized home teaching often leads to the meeting of similarly situated families, and this may lead to a willingness among parents to have joint classes in rotation at their homes.

The occupation centre should be an extension of good family life, rather than a refuge for outcasts from the orthodox schools. A centre should provide simpler environmental demands, and a slower pace of development and learning, though both these should be expected to continue to at least the age of fourteen, and to sixteen or even eighteen in some cases. Centres have been successfully run in a wide variety of premises; where the authorities have been genuinely enthusiastic, premises have usually been found or improvised.

The problem of staff is more difficult. Trainees should not, as a rule, be accepted before the age of twenty, and the first six months should be a probationary period. Previous experience with children is essential, though training for teaching is not required. It is important that the trainee have real expectation of enjoying the work, and of being acceptable to the children.

Training, of course, dates back to the days of Séguin and Montessori, but today courses of an intensive type are now available: the Royal Medico-Psychological Association conducts regular examinations upon the courses for mental deficiency nurses who wish to specialize in institutional care. For many years before the recent war the former Central Association for Mental Welfare ran holiday- and other short training-courses for the encouragement and initiation of staff. A one-year course is now given annually by the National Association for Mental Health for students from Britain, Eire and overseas. A similar course is being planned for a Scottish training college, under the Scottish Education Department. Refresher courses have long been popular, and have included visits from Britain to classes in Belgium, the Netherlands, and Denmark; there is in Britain an Association of Mental Health Workers, about half of whose members are engaged in training-work with the more severely mentally handicapped. Finally, there is the work of the fully-trained occupational therapists among high-grade unstable patients, where activity and teaching are primarily therapeutic and secondarily educational; Rampton State Institution is an example of this type of effort.

### 3. *Function of the Occupation Centre*

For senior pupils, activities should be fashioned after the routine of family life. The midday meal should, as far as possible, be planned, prepared, cooked and served with the help of the pupils; the use of meals delivered in containers, while convenient, involves a serious loss of training. The foundation of training consists of physical education, hygiene, handwork, speech training (including singing), and the recreation of stories and games, with some time for religious instruction and simple worship. The pupils may well share in

seasonal festivities, local shows, and such local and national efforts as savings campaigns and salvage collections. A successful centre will, in fact, take each child from his own starting point as far as possible in any direction of training.

Where numbers allow, a small nursery class will repay the additional effort. Very young defectives, especially of the mongolian type, often react to daily attendance at classes in a most encouraging way. However, the staff must be able and willing to give nursery attention, such as the superintendence of habit training, midday rest or sleep, and additional out-door activity. Some of the more stable and older girls at the centre can be very helpful working in the nursery under constant supervision. The day is past when a child had to be proved a failure in ordinary school over a period of years before he could get the type of training far better suited to him; the nursery section of an occupational centre should lay the foundations for the success of all the rest of the centre training. Children attending the centres will often not be able to travel alone; special buses, cars, or guides to escort pupils on public transport vehicles, are usually provided.

In an area in which both special schools and centres are provided pupils can transfer easily from one to the other. In Scotland the centres are by law included in the special school system, and recently procedure in England and Wales has been simplified to allow easy transfer, when needed, between ordinary and special schools. In some cases it is better for a more mature pupil of only centre standards in intelligence to attend the special school, while a timid, young, feeble-minded child could best start as one of the brightest pupils in a centre.

There have been isolated instances in Britain of a child being boarded out in a family, to be near a centre for training. The idea might be further explored, especially, perhaps, in the case of foster homes with a similar type of defective child. In one town a hostel was opened a few years ago for a group of suitable boys from the county institution, in order that they might attend the local occupation centre. As staffing and premises allow, this plan might be useful elsewhere. Needless to say, many children in institutions would benefit socially by living in a cottage, rather than in a villa in a colony.

The best arrangements for training the young will lose much of their value if some provision is not made for supervision to be continued into adolescence. Visits by a home teacher will encourage the pursuit of varied interests. Occasional reunions, merging into small clubs where feasible, have proved successful. Ensuring that ex-pupils of special schools and centres are not unnecessarily excluded from local youth activities will preserve for some of these boys and girls their hard-won social poise. Organized clubs, meeting only once or twice weekly in the winter months, make a genuine though unobtrusive contribution to mental health work. Full-time classes for youths and girls should be held wherever a centre exists. Home visits by qualified social workers, and sometimes by unqualified workers acting under skilled guidance, should be an integral part of the care of mentally handicapped persons not fit to be completely independent. To assess the eventual worth of centres and institutions it is necessary to keep and maintain records of progress.

Full-time employment is possible for some ex-pupils. There are good records of work in less skilled occupations, for example, in a biscuit factory; of steady domestic work in the maternity wards of a big hospital; and of good daily domestic work in private houses in a large number of cities where hostels exist for the girls. The value of some of the

more stable medium-grade defectives in the maintenance and utility services of large institutions and colonies can hardly be exaggerated. But, in all cases of employment, vigilance is needed to protect the mentally handicapped from exploitation, and to secure the full benefits allowed by legislation for insurances, or the partial rights individually assessed for his circumstances.

#### 4. Institutional Care

On the whole, children in institutions gain in physical care—they sleep better, have a better balanced diet, better nursing and medical attention. They also gain in having, as a rule, a playing field and a large hall, and sometimes a swimming-bath and gymnasium. When older, they have access to workshops and a great variety of activities within a colony. Larger institutions can provide more equipment as the cost, shared by so many, is proportionately less, and a greater variety of specialists can be employed.

Children in institutions, however, are the losers in those aids to development and stability which come from being loved and cherished as an individual by a small but permanent group of one's own kin. They also lose by lack of the everyday variety of any kind of family life, and by constant association with the same people of their own age-group and sex. They are weaker on general vocabulary, so that progress in reading and writing is slower. They tend to follow the behaviour pattern set by the institution; also, there is almost always too much of the "nursing" attitude to these young people who, though immature and slow, are not ill.

Institutions will always be needed, and more in every country than now exist. It is to be hoped that, some day, institutional workers of all types will have time for research and for keeping records of the work done and its results, so that the value of the widely differing routines may be compared.

#### 5. Value of Special Measures

Few would question that appropriately planned education and training will do much, perhaps all that can be done, towards the optimum development of the mentally defective individual. To those who doubt, however, whether such work is either necessary or helpful in a society planning for its own development, the following arguments are offered in support of the value of such work. When high-grade mentally handicapped children are taught in ordinary school classes they can seldom excel socially and never educationally; there is a steady and increasing sense of failure and uselessness; sustained effort is difficult for the growing pupil; he may become increasingly irritable in school, and turn to social misconduct or even crime. Such reactions are then regarded as signs and symptoms of inherent mental defect, instead of the results of inadequate provision for mental handicap. Where

suitable care and training have been provided, however, they can produce many useful and contented citizens, of one-half to three-quarters normal intellectual development but nevertheless able to carry out steady jobs and even become self-supporting within the resident colony or community.

High-grade defectives who do not make good are expensive failures; yet some of the instability of these children and adolescents is amenable to treatment. It is perhaps understandable that child guidance clinics have usually not been prepared to do more than diagnose the mentally deficient; stress has chiefly been laid on intensive analytical work with a fully co-operating patient. But play-therapy techniques of less rigid pattern have aided numbers of children, both of normal and impaired intelligence, and these techniques undoubtedly provide a means of therapy for worried or restless children with mental defect.

Only careful training can save low-grade children from steady deterioration towards levels of idiocy; they will require casual or, better, organized supervision throughout their lives. This will usually involve institutional care at some time. The task of nursing mentally defective persons can be needlessly boring, distressing, or even repulsive; it can never be easy, but it can be rewarding where training is fully encouraged.

In most countries the defective child is excluded from school, and the unemployable adolescent and adult remain at home. Aids to mental health are here imperative. Parents, especially mothers, are heavily burdened by the care of a defective child; the long, rather hopeless, extra years of feeding, dressing and undressing, supervision and teaching, and the constant effort to induce more tolerance among brighter siblings, all make life unusually hard. Help is needed in meeting the questions of growing brothers and sisters as to whether the condition of the defective is a punishment, "catching", or hereditary. Even those who know intimately a family with one defective child do not always fully realize the anxiety endured by the other children if their worries are not discussed with them.

The continuity of training of the mental defective is dependent upon community interest, and education of the general public will do much to assist this. Far too many half-finished projects have marked research work in mental deficiency. Teaching and training are only one aspect of the field; the causes of mental deficiency, and in some cases its prevention, should call for at least equal interest and research. Finally, many who work among defectives have come to find new criteria for happiness and contentment, and to realize that high intelligence, specific abilities, and knowledge and appreciation of world affairs are not fundamental but only relative criteria. The example of contented, useful defectives shows the importance of balancing the calls of environment against the capabilities of individuals, and the even greater importance of developing personal rather than intellectual factors.

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## MENTAL HEALTH COMMUNITY CARE

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- 1 Ex-Services After-Care Scheme
  - 2 Sources from which patients are referred
  - 3 Classification, types of problems, and disposal of patients
  - 4 Duration and results of community care
  - 5 Role and qualifications of social workers
  - 6 Other aspects of community care
  - 7 Factors influencing success
- Reference

The care of men and women suffering from nervous and mental disorders, but living free from restraint in their own homes, had its origin as a charitable and religious service. The individuals who undertook this care necessarily lacked a clear conception of the nature of these disorders or sufficient knowledge to see beyond the immediate need of the patients. After the foundation of the big mental hospitals in the 19th century, the difficult transition between the patient's life in hospital and his return home was to some extent eased by small voluntary homes—such as those established by the Mental After-Care Association, which began work in 1876—where recovering psychotics could live for a while, relatively free from the restrictions of the hospital but without the responsibilities of normal life.

The Central Association for Mental Welfare, formed in 1913, was a pioneer of the care by trained social workers of mental defectives in their own homes or in foster homes. Twenty years later the emergence of the new profession of psychiatric social worker made possible the extension of this idea to other classes of patients suffering from mental ill-health. The emphasis in this psychiatric social work was at first mainly on history taking and manipulation of the environment, but has gradually shifted, via interpretation of the social situation, to the role of the social therapist.

At the outbreak of war in 1939, after-care of patients by psychiatric social workers was undertaken in a few mental hospitals. Such after-care included the preparation of the patient's family for his return to normal life and visiting him at intervals after his discharge to help with the problems then arising. This work had so proved its value when undertaken by trained people that, when later large numbers of men and women were being discharged from the fighting Services for psychiatric reasons, often after less complete treatment than would have been possible in civil life, the Ministry of Health in January 1944 commissioned the National Association

for Mental Health to establish the Ex-Services After-Care Scheme for psychiatric casualties, under the general guidance of the Board of Control.

### 1. Ex-Services After-Care Scheme

This scheme, now known as the Mental Health Community Care Service, was a natural development of the concept of after-care and also, in several respects, a bold innovation. It deserves attention, as it is the only large-scale experience of modern community care yet available in Great Britain.

The Community Care Service has many novel features: for example, it has accepted all classes of psychiatric disorder; the patient's participation is entirely voluntary; it is nation-wide, but organized regionally, without close identification either with local authorities or with mental hospitals; it has been developed and operated by psychiatric social workers with a minimum of direction; circumstances have dictated the employment of teams of general trained social workers under the direction of a psychiatric social worker; and the Service has obtained in most districts the closest possible co-operation with other case-work agencies and with the Ministries of Health, Pensions and Labour.

There are approximately 15 psychiatric social workers and 37 assistants working from 20 offices, organized in regions corresponding to the Civil Defence regions. Provision has nowhere been adequate but the greatest demand has been found in those areas where it is most nearly so. Generous establishments of secretarial help and of transport are important requirements for successful operation.

### 2. Sources from which Patients are Referred

At first, patients about to be discharged from Service psychiatric hospitals, and later also those discharged under a psychiatric diagnosis from Service general hospitals, were asked if they wished to enter the scheme, the purpose of which was explained to them. On the average about one-quarter agreed, and these were visited by a worker from the scheme just before they left hospital, again at home about a month later, and thereafter as necessary. The success of after-care depends to some extent on the manner in which the first explanation in hospital is given and on the skill with which the first contact is made by the social worker.

As the reputation of the scheme grew, ex-Service patients discharged before the scheme was introduced started applying for help; but whereas the earlier patients had had a recent psychiatric investigation, the last-named had either no medical report or else an out-of-date one. This marked a significant change in the orientation of the scheme. After the end of the war, civilians came forward in increasing numbers and their right to receive help was conceded 2½ years after the start of the scheme. An important factor influencing their application for help seems to have been the reputation enjoyed locally by the social workers, for these patients usually had had neither medical nor psychiatric examination. Hence in 2½ years the scheme had progressed far beyond its original main purpose of after-care for ex-Service personnel.

The routes by which patients come for help (Table I) may indicate to some extent the value set on such a social service by the community. Coincident with the increased civilian entry and with greater local knowledge of the scheme, the proportion of "spontaneous" cases in the case-load is increasing rapidly. Less than half the patients are sent by doctors and hospitals and this proportion tends to decrease.

\* Since this article was written, administrative changes following on the introduction of the National Health Service have affected the position of this voluntary Association, so that the scheme here described is no longer functioning as an organized whole. It is hoped, however, that the useful work done by such voluntary organizations will be maintained.—Ed.



The Ministry of Labour and the voluntary agencies make up the remainder. These figures might reflect lack of knowledge of, or of confidence in, community care among doctors. Alternatively, it may be that many of the problems occurring are not regarded by the public as being within the sphere of the doctor; if proved, this would be a fact of medico-social importance.

**TABLE I. SOURCES FROM WHICH PATIENTS WERE REFERRED**

(September 1947—March 1948)

Sources	(a) Percentage of patients not referred directly from Service hospitals (3,780 patients)	(b) Percentage of the total case-load (6,639 patients)
Service hospitals under the Scheme ...		46.1
Private doctors and local authority medical services ...	32.9	20.6
Service and Emergency Medical Service hospitals ...	5.3	
Ministry of Pensions ...	4.9	
<i>From medical sources ...</i>	43.1	66.7
Patients, relatives or friends ...	20.7	11.8
"Spontaneous" ...	20.7	
Ministry of Labour ...	15.9	10.9
Official Services' Welfare ...	0.3	
Probation officers ...	2.6	
<i>Official social services ...</i>	18.8	
Voluntary social service organizations	12.7	9.9
Voluntary Service welfare organizations ...	4.6	
<i>Voluntary social services ...</i>	17.3	

Column (a) shows the percentage of patients who entered the Scheme from predominantly civilian sources (3,780 patients), i.e., excluding all patients sent direct by Service hospitals under the Scheme.

Column (b) shows, for comparison, the proportions of the main sources to the total case-load for the same period (6,639 patients).

The scheme accepted 14,500 patients in its first four years and on 25 March 1948 there were 4,277 patients in receipt of active care. Sex distribution was normal, i.e., women formed less than 10 % of Service cases and about 48 % of the civilian entry. In the four successive six-month periods from their first admission the proportion of civilians was 3, 8, 17 and 27 %, respectively, of the total case-load. Social classes among the civilian entry were normally distributed, except that there were fewer than might have been expected from among the lowest-income group. This suggests that there is a threshold in cultural standards below which a voluntary service of this type has less appeal, and so is less useful.

With no available standards for comparison, the optimum intensity of service is unknown. Active cases have, on the average, some form of consultation nearly four times in six months. Each social worker gives about 80 items of service

per month, taking about 130 cases in a six-month period (including closure of cases). It is thought that a current case-load of 80 is the maximum desirable for one worker in a well-populated district, with fewer in rural areas.

### 3. Classification, Types of Problems, and Disposal of Patients

*Classification.* In spite of the many sources from which cases are referred and the varied types of problem found, about 90 % of patients are susceptible to medical classification, and the remaining 10 % includes recent arrivals not yet sent for consultation. The relative proportions of neurotics and psychotics have remained practically unchanged for two years, and have not significantly altered with the larger civilian entry. The figures for the older-established general case-work of the National Association for Mental Health, which are given for comparison (Table II) show the differences in distribution of problems experienced by an agency well known for its work among mental defectives, for educational and foster-home placement of children and for general advisory services. The proportion of mental defectives dealt with by the Mental Health Community Care Scheme is no doubt reduced by the prior provision of facilities by the voluntary associations for mental welfare.

**TABLE II. MEDICAL CLASSIFICATION OF PATIENTS IN THE SCHEME**

A comparison with the figures of the National Association for Mental Health (N.A.M.H.)

Classification	(a) Percentage of total case-load of the Scheme (6,639 cases)	(b) Percentage of general case-work of the N.A.M.H. (2,484 cases)
Neuroses (including many types) ...	39.8	32.3
Psychoses ...	29.9	12.3
Mental deficiency ...	5.3	16.9
Psychopathic personality ...	7.3	—
Organic diseases (including epilepsy and post-traumatic cases) ...	7.3	3.3
Maladjusted children ...	—	5.6 (epilepsy)
Educationally subnormal children ...	—	2.0
Unspecified ...	10.8	21.9

Column (a) refers to the total case-load from September 1947 to March 1948 (6,639 cases).

Column (b) refers to the total number of new cases received by the National Association for Mental Health during the same period (2,484).

The method of classification in the two columns differs somewhat: in particular, children are not shown separately in column (a). "Unspecified" includes recent entrants not yet diagnosed and also a proportion of those who seek help for a vaguely felt need rather than for a defined reason.

*Types of Problems Encountered.* The assessment by the social worker of what is really the main problem in each case (Table III) may be little better than arbitrary but, with caution in interpretation, an indication of the main causes of difficulty may be obtained. In nearly 40 % of cases there are two or more co-existent difficulties, and in 27.5 % the problem cannot be specified, most of the latter being referred because of a general inability to get on without supervision and help.

**TABLE III. TYPES OF PROBLEMS ENCOUNTERED**  
(September 1947—March 1948)

Main problems or combinations of problems	Percentage of total case-load (6,639 cases)
Mainly medical problems ... ..	25.3
Medical and employment problems ... ..	13.2
Medical and domestic problems ... ..	5.2
<i>Medical problems an important factor</i> ...	43.7
Mainly domestic problems ... ..	2.8
Domestic and medical problems ... ..	5.2
Domestic and employment problems ... ..	1.5
<i>Domestic problems an important factor</i> ...	9.5
Mainly employment problems ... ..	7.9
Employment and medical problems ... ..	13.2
Employment and domestic problems ... ..	1.5
<i>Employment problems an important factor</i> ...	22.6
Medical, domestic and employment problems ...	55.9
Mainly housing problems ... ..	1.6
Other combinations of problems ... ..	14.7
For general supervision (including those with no specific problem) ... ..	27.5

"Medical problems" are those arising directly out of the patients' psychiatric condition; "domestic problems" include marital and family difficulties, and "employment problems" difficulties in finding and keeping suitable employment. It will be noted that in each main group the percentages of combined problems include problems in other groups. The table serves to show the main problems and where they overlap.

As might be expected, the most important factor is medical (43.7%), with employment difficulties second (22.6%), and domestic troubles third, with only 9.5%. The last figure does not fit in with the emphasis now laid on marriage problems as both a cause of, and a sequel to, emotional maladjustment. Again, the insignificance of housing as a problem (1.6%) may

**TABLE IV. DISPOSAL OF PATIENTS**

Action taken	Percentage of total case-load (6,639 cases)
Referred to out-patient psychiatric clinics ...	18.9
Admitted to Emergency Medical Service Neurosis Centre ... ..	2.5
Referred to Ministry of Pensions for consultation	0.6
Admitted to mental hospital:	
voluntary patients ... ..	6.4
certified patients ... ..	2.9
for observation ... ..	0.6
Refusal by patient or relatives to co-operate in seeking consultations ... ..	6.0
General supervision by social worker ... ..	62.1
New cases admitted during period under review	35.1
Cases closed during period under review ...	35.5

The figures refer to the total case-load for the period September 1947 to March 1948 (6,639 cases). The number of cases being actively dealt with at the beginning of the period was 4,521.

cause surprise, though it may be that cases in trouble over housing go elsewhere for help.

It should be noted that no patient is, or should be, referred to the scheme solely because he is in need of financial relief, and this aspect of social work has been small in the scheme: only 4.4% have had financial assistance procured for them in the period under review.

*Disposal of Patients.* A bird's-eye view of activities under the scheme can be obtained from Table IV, but its exact significance is to some extent a matter of speculation.

The amount of out-patient psychiatric treatment is less than might be expected. In almost every district the social workers report that clinics are inadequate in number and relatively inaccessible to the more distantly placed patients, and are frequently so pressed that they provide little more than a diagnostic service. This combination of circumstances must tend to depress treatment figures.

The proportion of patients in the scheme admitted to mental hospitals (10%), compared with that of known psychotics under care (30%), suggests that the scheme is gaining valuable experience in the social supervision of chronic and recovering psychotics. It is evident that the scheme's main contribution is social care and help, but every case is now subject to review periodically by a psychiatrist.

*Co-operation with General Practitioners.* In the year under review there has been more contact with the patients' own doctors than previously: from September 1947 to March 1948 local doctors were consulted in respect of 33.6% of the case-load (new admissions for the period being 35.1%).

*Employment of Patients.* About 54% of patients are gainfully employed (Table V), mainly through their own efforts. They are far from being helpless or a dead loss to the community. The current return of 3,655 patients in employment gives 76 occupations, including two doctors, many other professional people, skilled and unskilled tradesmen, labourers, and even one neurotic man employed as a lion-tamer!

**TABLE V. PROPORTION OF PATIENTS EMPLOYED**  
(September 1947—March 1948)

Diagnosis	Employed (%)	Unemployed (%)	Not known (%)	Total (%)
Neurosis ... ..	25.1	9.3	5.0	39.4
Psychosis ... ..	15.3	12.4	2.1	29.8
Psychopathic personality ... ..	4.2	2.1	1.0	7.3
Mental deficiency ... ..	2.1	2.7	0.5	5.3
Organic disease ... ..	3.0	3.3	0.7	7.0
Unspecified ... ..	4.0	5.0	2.2	11.2
Total ... ..	53.7	34.8	11.5	100.0

These figures refer to the total case-load for the period September 1947 to March 1948 (6,639 cases). 187 patients changed their jobs during the period and are recorded twice, thus causing minor variations from Table II. The group of organic diseases includes a high proportion of elderly people, and that of the unspecified a high proportion of children and of members of the "social problem" group.

As might be expected, neurotics have a higher employment rate than psychotics. Medical unfitness for work accounts for 52% of the unemployment, and lack of suitable work for only 10%. Among those classified as unemployed are housewives (12%), children (8.7%) and students on training courses (8%).

#### 4. Duration and Results of Community Care

It is impossible to apply reliable criteria of improvement or deterioration, or to interpret with any confidence the alterations due to environmental chance. Usually patients are retained on the active list until they no longer need help and if they break away in dissatisfaction their case is not closed until it is certain they will not return. A few cases are closed because it is found impossible for the social workers to give help—as in the un-co-operative group described below.

The training of psychiatric social workers does not normally envisage responsibility for closing cases, and recently the employment of consulting psychiatrists has eased difficulties in this matter to some extent. As a result of this and of increasing experience all round, the proportion of cases closed during the last two six-month periods has risen from the previous level of 21.5 % of the case-load, to 29 % and then to 35.5 %.

Patients showing deterioration remain with the scheme as long as a useful purpose is served or until their condition necessitates hospitalization. Apart from those who remove or die, the remaining cases are closed as improved, i.e., able to get on in life without social help. There have been 3 or 4 cases of suicide and one of murder per year; in every case, except one living remote from a social worker and therefore inadequately supervised, the patients were under direct medical care at the time of the tragedy.

It appears that two years is a reasonable time for a patient usefully to remain with the scheme, except for a small group of mildly incompetent permanent cases who can be kept socially stable with a minimum of supervision.

From the outset about 8 % of patients, although entering the scheme voluntarily, have persistently refused to accept advice, or in some other way have defeated the efforts of the social worker. They do not, however, disappear, but return again and again for the advice and help they will not accept. This constant phenomenon deserves more exact study.

#### 5. Role and Qualifications of Social Workers

The Mental Health Community Care Scheme has developed rapidly in many directions from its origin in the After-Care Scheme. Its success lies in its several distinctive contributions to social casework, the clinical aspects of which have been fully described elsewhere (Goldberg, 1947).

When cases come from other than medical sources, the community care social worker cannot avoid having some diagnostic function. As a first step, there is an Advice Bureau—telling enquirers how and where to get help; but after this, and more profoundly, there is assessment of the urgency of a case and application of “psychiatric first-aid”, that is, overcoming doubts and hostile attitudes, and preparing the patient and his relatives for psychiatric investigation, all of which tasks require skill and confidence.

After psychiatric consultation the social worker may merely have to follow medical instructions, though even this may call for great ingenuity and patience. Usually much more is required of her; at the least she must receive and keep the patient's confidence; more probably she will become a general guide, philosopher and friend, and in some cases a parent figure. Without encroaching on the doctor's position she must fulfil her function of social therapist.

The psychiatric social worker's most important function is to consider the case as a whole. She must be competent to

deal with medical, psychiatric, sociological and economic aspects alike; whereas nearly all other agencies (including doctors) have a marked tendency to view the case in the light of their own special interest. In exchange for specialist advice, the worker brings the significance of the social situation to the psychiatrist's attention, acting, if required, as an intermediary between him and other social agencies. She attempts to interpret the patient's own state to himself and to explain his special problems to his family, his employer and his friends, while helping the patient to meet the demands made on him by the community. Such activities will involve the co-ordination of other social agencies which otherwise tend to deal in piecemeal fashion with only those symptoms which concern them.

In attempting to execute a planned withdrawal of support from a recovering patient—a lesson learnt from psychoanalysis—community care is perhaps unique among social agencies. The management of the patient's slow and difficult return to independence is the social worker's most difficult task.

An attempt to conduct such a service with untrained or partially trained personnel might lead to disaster. Ideally, only psychiatric social workers holding a Mental Health Certificate would be employed, but there is probably a useful function for teams of experienced assistants with social science diplomas, each working under the personal supervision of a psychiatric social worker. Social work demands a broad general education and wide sympathies, without which it is apt to become merely technical and sterile.

There is general agreement that social workers should possess a “suitable personality”, but there is great dispute as to what this is and how it can be selected. A proved ability to handle the patient's attachments wisely is a *sine qua non*, and this cannot be implanted merely by training. The work calls for male as well as female social workers of good education, and the present standard of salaries is a great obstacle, particularly to the recruitment of men.

#### 6. Other Aspects of Community Care

In addition to general psychiatric case-work, as described above, and to the “follow-up” of ex-hospital patients, Mental Health Community Care should include other provisions: e.g., boarding out of mental patients in private homes, as in New York State, or in villages as in Belgium; working hostels for mental defectives, chronic mild psychotics, severe neurotics, epileptics, etc.; sheltered workshops for mentally disabled persons, combined with social supervision of living conditions; home occupations; and vigorous preventive measures, educational, medical and social, through advice bureaux and guidance clinics.

In the opinion of most social workers engaged in mental health community care, the inclusion in their duties of the ascertainment of mental illness and defect—which may often result in certification—is likely to embarrass their relations with the public to such an extent as to be a serious handicap.

#### 7. Factors Influencing Success

To epitomize the experience of the Ex-Services Scheme: it appears to be important that a Mental Health Community Care Service should be so accessible to the public that every potential patient, or relative, knows (or can easily find out) where to go for help, without having far to go or long to wait.

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# THE PRESENT POSITION OF MENTAL NURSING IN ENGLAND

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- 1 The work of the mental nurse
  - 2 Recruitment and training
  - 3 Indications for future training
- Reference  
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Mental patients form a mixed group, ranging from the frankly psychotic, the psychopathic and the mentally defective to those suffering from neuroses and psychosomatic disorders. It is obvious, then, that what a patient needs from a mental nurse will vary. The psychotic and mentally defective may require full-time care in an institution; the neurotic may well be able to care for his own bodily needs but requires intelligent appraisal and guidance in dealing with his emotional requirements. The psychopath requires what is for him the most unpleasant medicine of all, discipline.

## 1. The Work of the Mental Nurse

The work of the mental nurse will thus vary according to the type of patient cared for. In a private hospital there will be a demand for better amenities—hot water to be fetched to private rooms, clothes to be marked, more time to be spent on serving meals, and so forth. A public hospital, because of the large numbers of patients to be served, requires concentration on seeing a large number of patients through the toilet room, and on getting them dressed, sitting at table, and served promptly with a meal which has to be cleared quickly so that the day's work can be continued. Twelve new patients in an admission ward will require more detailed observation

and care than 120 patients of long standing who are able to be at work about the hospital most of the day. In a neurosis unit a nurse may gain enough experience to participate actively in the psychiatric treatment directed by the doctor, but not enough experience of acute illness to be able to deal with a sudden outburst of psychotic behaviour.

Specialization in the mental hospital has been necessitated, even encouraged, by the shortage of nurses and reduction in their working hours; occupational therapists, physical training instructors, domestics, porters and others now share the load previously carried by the nurses alone. While in some ways this has relieved the weight of work, it has to a certain extent narrowed its range and interest. Occupational therapy, for instance, could well be considered a form of nursing treatment, but it is not usually left to the nurse to carry out.

## 2. Recruitment and Training

Should a mental nurse be trained to deal with all types of patient and carry out all types of treatment, or should specialization in dealing with one or two types be encouraged? That is, should training be professional and based on principles which can be applied in any circumstances, or should it be empirical, learned by daily experience, and accordingly limited in scope? The type of training it is possible to give will depend to a large extent on the quality of the recruits available to take up the work; the training must, to some extent, be fitted to the available students. Nurses who are to hold higher posts, supervising and directing the work of others, and participating in the management of the hospital, need a type of training wider in its scope than is available today.

In the past there was a steady flow of stable people of average intelligence to work as mental hospital nurses. Recruitment was mainly from the locality around the hospital; there were villages where most of the inhabitants worked at the hospital in one capacity or another, and brought up their families to do likewise. During the economic depression of the 1920's, mental nursing offered a steady, comparatively well-paid job, with a pension. The hospital authorities were able to choose the best from a number of applicants, and these recruits were willing to work hard to qualify; old lecture registers show good attendances and good examination results. These figures fall off after the early 1930's when other employment became more attractive and more readily available.

## COMMUNITY CARE

*Continued from page 210*

Ideally there should be an "over the counter" service on demand, as well as interviews or visits by appointment. Letters of introduction should never be insisted on, though they may be useful for conveying a case-history to the worker. There must be no irritating delays while questions of settlement or entitlement are argued.

Applying for advice or help should be to the patient a step even simpler than going to see his own doctor; it must commit him or his relations to nothing. Advice is later taken and help accepted only with the free consent of the patient. It would seem wise that the service be not conducted by the local mental hospital as part of its avowed activities; and, more emphatically, that certification be not undertaken either on the same premises or by the same personnel as community care.

Any leakage of confidential information, especially in small country towns, is disastrous and all staff, including clerical, must realize the necessity of absolute discretion. The fewer staff changes in all grades, the better for the service.

The service should be highly skilled; only trained, experienced social workers of known stability of personality should be employed. Each case should ultimately come under the personal responsibility of a psychiatric social worker who is herself in regular consultation with a psychiatrist.

The best demonstration of the effectiveness of a Mental Health Community Care Service is the extent to which it is freely used by the community it is designed to serve.

## REFERENCE

Goldberg, E. M. (1947) *J. ment. Sci.* 93, 374

During and since the war the attractions of factory work have made it difficult for mental hospitals to secure recruits. Mental hospitals are often situated in remote villages, with no labour-saving devices and infrequent transport, and the work required is inherently difficult and sometimes distasteful. Certain trends in the structure of the population have also tended to reduce the number of recruits available for nursing; the school-leaving age has been raised from 14 to 15 years (and will eventually be 16), the average age of marriage for women has fallen from 26 in the 1920's to 24 today, and with the general improvement in wages and employment throughout the country, fewer married women have had to go to work (Hubback, 1947).

In line with the development of the nursing profession as a whole the highest ranks on the female side were, before the war, filled by experienced women with both general and mental training. The men did not become doubly qualified in the same numbers, because there were fewer general hospitals willing to take male student nurses; also if a man took general nursing training he earned a much lower salary during this period and lost those years of contribution towards a pension. There was little incentive for men to make the sacrifice, since promotion was by seniority and not by qualification.

Since the war, men who had had good nursing experience in the armed forces and elsewhere have been given the opportunity of completing their general training in one year instead of the three normally required, and many more general hospitals have taken male nurses as students. Promotion of male mental nurses now depends on their holding the double qualification, and as competition for promotion is keen the younger men are making every effort to qualify. On the other hand, owing to the shortage of staff in the general hospitals, female nurses who went to them from mental hospitals for general training are staying on; there is great anxiety over the dearth of suitable doubly-qualified female nurses for the higher posts in mental hospitals. There is also a shortage of female staff nurses, and whereas the teaching of mental nurses used to be carried on by female tutors, it is now increasingly difficult to find suitably trained women, and male tutors are increasing in numbers.

At the same time there is a universal complaint that the quality of recruits has fallen, as well as their number. New nurses are less stable and less well educated than they were 20 or even 10 years ago. As a result they cannot or will not study, and show great reluctance to train and take an examination. When the time comes, many leave rather than take even the preliminary examination.

The employment of part-time workers has temporarily enabled hospitals to continue their work, but the seriousness of the situation is shown by the fact that in some cases the number of part-time workers is double the permanent staff.

At present, some of the part-time workers are trained mental nurses who have married and settled down near the hospital; but it is clear that this source of trained staff will shortly be exhausted.

### 3. Indications for Future Training

To meet this situation it follows that more attention must be paid to the ability and interests which recruits to mental nursing show. They can no longer be compelled to study, so the classroom work will have to be presented in a more stimulating way, and be more closely related to the work they are doing day by day, so as to maintain their interest. If the prevailing phobia about examinations persists, there will have to be some other way of assessing the practical abilities which the nurses show in their work. In short, as things are at present, an empirical rather than a professional training is required for the great majority of our recruits. Further, as so many of the female staff now work only part-time, experience should be assessed, not so much in terms of length of service, but in terms of capability, so that whatever recognition is given to practical experience is available to part-time as well as full-time workers.

Nurses who are to hold the higher posts, supervising and directing the work of others and the management of the hospital, will need a type of training wider in its scope than that available to nurses today. At present we have only one level of training for mental nurses, and that was designed to suit the average. Most of our recruits are failing to reach even this standard, while the few really able ones are bored by it, and we are losing some of these potential leaders by failing to provide sufficient scope and interest for them.

The training of the mental nurse should not be planned in isolation from the psychiatrists and other grades of worker; all should work together. Too often the psychiatrist takes a good nursing service for granted and does not feel it a part of his work to help in stimulating and maintaining the nurses' interest and co-operation. In these circumstances, the nurses often fail to understand what is required of them, with the result that the nursing is often less efficient than it could be.

In future, it may be necessary to give appointments previously held by women to male nurses; if this is not done, it would seem that in a very few years the female patients in our mental hospitals will be cared for by partially trained nurses or untrained domestic workers.

At present there is still a lingering stigma attached to anything connected with the mentally ill. Until this is removed and mental nursing is considered a profession of which anyone might be proud, the shortage of staff will continue, the work of the psychiatrists will be hampered, and lastly and most important, the patients will not get the care they need.

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## BRITISH ORGANIZATIONS CONCERNED WITH MENTAL HEALTH

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Voluntary bodies have played an important part in the development of the existing mental health services. In promoting the study of mental health and providing for the training of mental health workers, as well as in encouraging research and fostering new experimental methods of treatment, they continue to fulfil an essential role in the mental health activities of this country.

The main burden of caring for the mentally sick is borne by the mental hospitals and by the psychiatric out-patient departments attached to the general hospitals, which are now included under the National Health Service. A few of the general hospitals run clinics for child guidance, speech therapy and similar work; but many of the clinics providing special forms of treatment, as well as the maternity and child welfare centres, are still in the hands of voluntary bodies.

The following list of organizations includes most of the main bodies in Great Britain primarily concerned with mental health; but the list is not exhaustive, for it would be possible to name many other organizations, such as those under the auspices of the various religious denominations, which take an active interest in mental health. Individual mental hospitals and institutions primarily for treatment are not included, nor has it been possible to include more than a few of the educational and social organizations which are engaged in activities related to mental health.

**Association for Education in Citizenship, 51 Tothill Street, London, S.W. 1**

The object of the Association is "to advance training in citizenship, by which is meant training in the moral qualities necessary for the citizens of a democracy, the encouragement of clear thinking in everyday affairs and the acquisition of a knowledge of the modern world." The methods used include the publication of books and pamphlets. Conferences are arranged and speakers are available. An information service is maintained and research is carried out.

**Association of Mental Health Workers, 39 Queen Anne Street, London, W. 1**

This Association promotes the work and status of those engaged in mental health activities.

**Association of Occupational Therapists, 251 Brompton Road, London, S.W. 3**

**Association for Promoting Employment of the Mentally and Physically Defective, 39 Lillie Road, London, S.W. 6**

The Association is concerned with obtaining employment for the mentally and physically defective in London.

**Association of Psychiatric Social Workers, 1 Park Crescent, London, W. 1**

The Association seeks to promote the study of psychiatric social work and to maintain the status of workers engaged in this field. It publishes the *British Journal of Psychiatric Social Work*.

**Aylesbury After-Care Association**

Now the Women's and Girls' After-Care Division of the Central After-Care Association, *q.v.*

**Biochemical and Endocrinological Research Department, Bristol Mental Hospitals, Fishponds, Bristol**

Research is carried out, mainly by biochemical and endocrinological methods, on scientific and clinical problems related to the nervous system.

**Board of Control, 32 Rutland Gate, London, S.W. 7**

The Board of Control was established by the Mental Deficiency Act, 1913, and reorganized by the Mental Treatment Act, 1930. It consists of a Chairman and not more than five Senior Commissioners. The Board's functions comprise the powers and duties conferred on them by the Lunacy and Mental Treatment Acts, 1913-1938, as amended by the National Health Service Act, 1946. The Minister of Health is responsible to Parliament for the work of the Board of Control.

**Borstal Association**

Now the Borstal After-Care Division of the Central After-Care Association, *q.v.*

**British Council for Rehabilitation, 32 Shaftesbury Avenue, London, W. 1**

The Council is a co-operating and co-ordinating body concerned with the treatment, training and resettlement of all disabled persons. The Council set up two specific activities in 1948—the Preparatory Training Department to provide training for long-stay hospital and sanatorium patients, and the National Association for the Paralysed to deal with the welfare of the paralysed.

**British Institute of Management, 17 Hill Street, London, W. 1**

The Institute seeks to encourage the study and application of scientific methods of management, particularly in industry; it is concerned with factors affecting conditions of work and the relationship between employers and employees.

**British Psychological Society, Tavistock House South, Tavistock Square, London, W.C. 1**

The Society "exists to promote the advancement of the study of psychology and its applications, and to maintain high standards of professional education and conduct." The journals published include: *British Journal of Psychology* (General Section), *British Journal of Psychology* (Statistical Section), *British Journal of Medical Psychology*, and *British Journal of Educational Psychology*. A selection of current journals on psychology and related subjects is available in the library, which is situated in the Senate House, University of London, W.C. 1.

**British Rorschach Forum, c/o Tavistock Clinic, 2 Beaumont Street, London, W. 1**

The Forum is an independent body designed to safeguard professional standards in the use of the Rorschach test, to provide interchange of ideas among members, and to encourage research. Its constitution provides for Fellowship and Membership. Fellowship is confined to those of senior status among psychologists and psychiatrists, and implies ability to teach the method.

**British Social Hygiene Council, Tavistock House North, Tavistock Square, London, W.C. 1**

The Council promotes the application of biological knowledge to social problems, e.g., population trends, sexual promiscuity and prostitution.

**British Society for Research on Ageing, c/o Department of Physiology, The University, Oxford**

Meetings are held at which scientific papers are read and research on ageing is promoted.

**Burden Neurological Institute, Stoke Lane, Stapleton, Bristol**

The Institute is mainly concerned with research on scientific and clinical problems related to the nervous system. There are laboratories for work on electrophysiology, endocrinology, biochemistry and physiological psychology. Electroencephalographic research is carried out and a course is arranged for the training of electroencephalograph operators.

**Central After-Care Association, England & Wales**

This Association was appointed by the Secretary of State for the Home Department under the relevant provisions of the Criminal Justice Act, 1948, to undertake the supervision of persons conditionally released from Borstal training, corrective training and preventive detention and of young prisoners released on licence from sentences of imprisonment. It is also the society approved by the Secretary of State to receive information of the addresses of persons discharged from prison under the provisions of section 22 of the Criminal Justice Act. The governing body of the Association is a Council of twenty members representative of after-care organizations, Prison Commissioners, Government Departments and persons interested in the problems of this branch of social service.

The duties of supervision, which include such help, financial or otherwise as is required, are undertaken by three Divisions of the Association each under its Director:

- Women and Girls . . . . . *Women's and Girls' After-Care,*  
66 Eccleston Square Mews,  
London, S.W. 1
- Borstal and young  
adult prisoners (under  
21 when sentenced) . . . . . *Borstal After-Care,*  
19 Chester Square,  
London, S.W. 1
- Men . . . . . *Men's After-Care,*  
66 Eccleston Square,  
London, S.W. 1

**Central Association for the Aid of Discharged Convicts**

This is the After-Care Division of the Central After-Care Association.

**Central Association for Mental Welfare**

This Association was amalgamated with the National Association for Mental Health in 1946, *q.v.*

**Central Council for Health Education, Tavistock House North, Tavistock Square, London, W.C. 1** (Division for London, Middlesex and Hertfordshire); **7 Victoria Street, London, S.W. 1** (Division for Surrey, Sussex, Kent and Essex)

The Central Council is recognized by the Ministry of Health as the organization primarily responsible for supplying local authorities with services and material in connexion with their work in health education. The Council's services are also used by other organizations and individuals concerned with public health, hygiene, nutrition, etc.

**Child Guidance Council**

This Council was incorporated into the National Association for Mental Health in 1946, *q.v.*

**Child Guidance Training Centre, 6 Osnaburgh Street, London, N.W. 1**

The Centre was founded in 1929 as the London Child Guidance Clinic by the Commonwealth Fund of America and is now part of the National Health Service. Its main objects include the psychological investigation and treatment of maladjusted children and the training of child psychiatrists, educational psychologists and psychiatric social workers. Courses for students of all these branches of the work are conducted continuously and there is also a programme of active research, mainly into the educational treatment of handicapped children.

**Child Study Society, Westover, West Malvern, Worcestershire**

The Society promotes the study of the educational methods and environment best suited to ensure the mental and physical development of normal and feeble-minded children.

**Electroencephalographic Society, 68 Compton Road, Winchmore Hill, London, N. 21**

The Society was founded to promote the study of electroencephalography and allied subjects and to maintain the status of assistants engaged in electroencephalographic recording. Meetings are held at which scientific papers are read.

**Eugenics Society, 69 Eccleston Square, London, S.W. 1**

The Society exists "to study the influences, social and genetical, that may modify inborn human qualities; to formulate and support policies for developing these qualities to the utmost advantage; to promote research upon eugenic problems; and to foster a responsible attitude to parenthood." The Society organizes meetings at which scientific papers are read and it publishes the *Eugenics Review*.

**Ex-Services Welfare Society, Temple Chambers, Temple Avenue, London, E.C. 4****Family Planning Association, 69 Eccleston Square, London, S.W. 1**

The Association has organized a large number of women's welfare centres and clinics throughout the country. Advice is given on matters relating to family planning, sterility and difficulties connected with the marriage relationship. An international congress on "Population and World Resources in Relation to the Family" was organized by the Association in 1948.

**Federation of Committees for the Moral Welfare of Children, 170 Sheen Court, Richmond, Surrey**

The Federation is concerned with the education and care of children in moral difficulties.

**Guild of Health, 8 Kensington Park Road, London, W. 11**

The Guild aims at bringing together doctors, nurses, psychologists and ministers of religion, in the study of mental, physical and spiritual factors in healing. The Guild arranges lectures and conferences; it publishes the *Guild of Health Magazine*.

**Home and School Council of Great Britain, 109 Fulham Palace Road, London, W. 6**

By means of publications (books, pamphlets and a magazine, *Home and School*), written by acknowledged educators and psychologists, the Council aims at spreading in simple form the understanding of how children and adolescents develop. It does this largely through parent-teacher associations which it helps to form and federate into a national body and to which it supplies lectures.

**Howard League for Penal Reform, Parliament Mansions, Abbey Orchard Street, Victoria Street, London, S.W. 1**

The League seeks to promote efficient methods for the treatment and prevention of juvenile delinquency and of crime. The League publishes *The Howard Journal*.

**Industrial Health Research Board, 38 Old Queen Street, London, S.W. 1**

The Board is a standing advisory committee of the Medical Research Council, with the following terms of reference:

"To advise and assist the Medical Research Council in promoting scientific investigations into problems of health among workers, including occupational and environmental factors in the causation of ill-health and disease, and the relation of methods and conditions of work to the functions and efficiency of body and mind; and in making known such results of these researches as are capable of useful applications to practical needs."

The detailed consideration of research work is in the hands of scientific committees dealing with such subjects as occupational medicine, occupational physiology, occupational psychology, industrial pulmonary diseases, toxicology and statistics.

**Industrial Neurosis Unit, Belmont Hospital, Brighton Road, Sutton, Surrey**

The Unit is for the psychiatric treatment of patients in whom occupational problems play a prominent part. It is the largest neurosis centre of the kind in England and original work has been carried out here on "psychodrama" and other special

forms of treatment. Special facilities are available for post-graduate teaching and a six-months' course for candidates for the Diploma in Psychological Medicine (D.P.M.) is arranged.

**Institute of Child Health (University of London), Hospital for Sick Children, Great Ormond Street, London, W.C. 1**

Among the general activities of the Institute are included courses of lectures on psychological medicine in children.

**Institute of Child Psychology, 6 Peinbridge Villas, London, W.11**

The activities of the Institute include an out-patient clinic for the treatment of psychological disorders of children of all ages up to 18 years. Training courses are organized.

**Institute of Education (University of London), Malet Street, London, W.C. 1**

The activities of the Institute include research in education and in educational psychology. Courses for the training of teachers are arranged.

**Institute of Psychiatry, Maudsley Hospital, Denmark Hill, London, S.E. 5**

This Institute is one of the institutes of the British Postgraduate Medical Federation and is concerned with research and the postgraduate teaching of psychiatry and allied subjects. There are biochemical, electrophysiological, neuropathological and psychological laboratories. Clinical instruction and systematic lectures and demonstrations are provided; these cover the requirements of the Diploma in Psychological Medicine (D.P.M.), and appropriate instruction and facilities are available for those working for higher degrees such as the M.D. or Ph.D.

**Institute of Psycho-Analysis, 96 Gloucester Place, London, W. 1**

Full training is given in the theory and practice of psycho-analysis. The course is part-time, lasts four years and consists of a personal analysis, the analysis of patients under supervision, lectures and seminars.

**Institute for the Scientific Treatment of Delinquency, 8 Bourdon Street, Davies Street, London, W. 1**

The Institute promotes scientific research into the causes and prevention of crime.

**Institute of Social Medicine, 10 Parks Road, Oxford**

The purposes of the Institute include: (i) the investigation of the influence of social, genetic, environmental and domestic factors on the incidence of human disease and disability, and (ii) the promotion of measures, other than those usually employed in the practice of remedial medicine, for the protection of the individual and of the community against such forces as interfere with the full development and maintenance of man's mental and physical capacity.

**Institute of Social Psychiatry Limited, 7 Fellows Road, London, N.W. 3**

The Institute is concerned with the study of the social causation and cure of those suffering from nervous and mental disorders, with special emphasis on the social implications. With this object, it has established a number of rehabilitation and occupational centres, day hospitals, therapeutic social clubs and other self-governing associations of patients. Six clubs are under direct control of the Institute and a number of others have been started in collaboration with various teaching hospitals. Research is being carried out on the use of social psychotherapy as an alternative to out-patient treatment. Lectures and demonstrations are organized and a Bulletin is to be published by the Institute.

**Institute of Sociology, Le Play House, Ledbury, Herefordshire**

The Institute promotes: (i) the study of human communities; (ii) the use of sociological studies in education, and (iii) the application of sociological studies to urban and rural development. The Institute publishes the *Sociological Review* and various bulletins. Discussion meetings are held regularly in London.

**London Police Court Mission, 152 Clarence Gate Gardens, Baker Street, London, N.W. 1**

The Mission gives assistance in personal matters to those who have offended against the law.

**The Magistrates' Association, Tavistock House South, Tavistock Square, London, W.C. 1**

This Association arranges conferences of magistrates throughout Great Britain, and every two months publishes a bulletin, *The Magistrate*, for its members.

**Medical Research Council Unit for Applied Psychology, The Department of Psychology, Downing Street, Cambridge**

The unit is engaged in laboratory and field research on environmental factors affecting human performance. Problems under investigation include: (i) the optimum tempo in industrial tasks; (ii) the causation of accidents; (iii) the selection of medical students, and (iv) sources of error affecting mental tests.

**Mental After-Care Association, 108 Jermyn Street, London, S.W. 1**

The Association facilitates the re-admission into normal social life of persons recovering from nervous and mental disorders. Persons discharged from mental hospitals are assisted to obtain suitable employment and consideration is given to their personal needs. Arrangements are made for convalescent treatment.

**Mental Health Research Fund, c/o The Director, Neuropsychiatric Research Centre, Whitchurch Hospital, Cardiff**

The purpose of the Fund is to promote, finance and encourage research on mental health and disease. The aims include: (1) The study of the factors conducive to the fullest development and maintenance of man's mental capacity. (2) Research on the causation, prevention and cure of nervous and mental disease. (3) Research on fundamental problems related to mental health. (4) Research on the forms of social structure most likely to lead to the improvement of the mental quality and stamina of the community, and most likely to reduce the incidence of addiction, delinquency and crime. The methods used include the provision of suitable grants and fellowships for research.

**Mental Nurses and Mental Deficiency Nurses Guild of the Confederation of Health Service, 1 Rushford Avenue, Leverhulme, Manchester, 19**

The Guild seeks to promote the co-operation of all who are engaged in the National Health Service and to maintain the status of the nursing profession.

**Moor House School, Hurst Green, Oxted, Surrey**

The School provides treatment and specialized education for children of 5 to 11 suffering from speech defects.

**National Association of Boys' Clubs, 17 Bedford Square, London, W.C. 1**

The Association aims at promoting the mental, physical and social well-being of boys, especially those in poor circumstances.

**National Association of Discharged Prisoners' Aid Societies, St. Leonard's House, 66 Eccleston Square, London, S.W. 1**

The Association co-ordinates and furthers the work of Discharged Prisoners' Aid Societies throughout the country.

**National Association for the Feeble-Minded, 296 Vauxhall Bridge Road, London, S.W. 1**

The organization is concerned with the care and control of the mentally defective. A farm colony and a group of homes are maintained for this purpose.

**National Association of Girls' Clubs and Mixed Clubs, Hamilton House, Bidborough Street, London, W.C. 1**

The Association co-ordinates the activities of National Societies and Unions of Girls' Clubs and Mixed Clubs; it aims at promoting the mental, physical and social welfare of working girls and boys. It maintains an employment bureau and publishes a monthly magazine, *Club News*.

**National Association for Maternity and Child Welfare, 5 Tavistock Place, London, W.C. 1**

The Association exists for the furtherance of education in matters connected with maternity and child welfare, for the study and prevention of mortality and of ill-health among mothers and young children. It publishes and distributes

books, journals and pamphlets promoting a sound knowledge of maternity and child welfare. It undertakes the collection and publication of statistics and reports; it organizes conferences and meetings, local, national and international, and acts as a consultative body in connexion with maternity and child welfare.

**National Association for Mental Health, Maurice Craig House, 39 Queen Anne Street, London, W. 1**

The National Association for Mental Health serves as a co-ordinating body for the activities of other national and international organizations concerned with different aspects of mental health. It was formed by the amalgamation of three voluntary bodies: the Central Association for Mental Welfare, the National Council for Mental Hygiene and the Child Guidance Council. Among the many activities of this Association has been the provision of training facilities for social workers at various centres throughout the country. The Association runs advisory services on schools, homes and clinics for persons suffering from mental disorders and it provides courses, lectures and conferences for the general public and for professional groups. The Association organized the International Congress on Mental Health held in London in 1948. A lending library service is conducted and the Association publishes a quarterly journal, *Mental Health*.

**National Association of Prison Visitors, 6 Old Bailey, London, E.C. 4**

The Association brings together those engaged in the work of visiting prisoners and in making representations, when necessary, to the Prison Commissioners.

**National Association of Probation Officers, 2 Hobart Place, Eaton Square, London, S.W. 1**

The Association seeks to promote the health, education and social welfare of the community through the practice of probation; investigations are carried out by medical, psychological and other methods on the causes and treatment of delinquency.

**National Council for Mental Hygiene**

This Council was incorporated in 1946 in the National Association for Mental Health, *q.v.*

**National Council of Social Service, 26 Bedford Square, London, W.C. 1**

The Council promotes the co-operation of voluntary agencies and public authorities concerned with social service. It provides a headquarters for the Citizens Advice Bureaux Service, which is established throughout the country. It acts as an advisory body for occupational clubs and community associations in urban neighbourhoods. The Council maintains a library and a books advice service.

**National Council for the Unmarried Mother and her Child, 21 Coram Street, London, W.C. 1**

The Council promotes legislative reform and co-ordinates the activities of voluntary and statutory organizations.

**National Hospital, Queen Square, London, W.C. 1**

In addition to the treatment of patients suffering from neurological conditions, research is carried out on fundamental and clinical problems related to the nervous system. There are facilities for electroencephalographic investigations and for the training of electroencephalograph operators.

**National Institute of Industrial Psychology, Aldwych House, London, W.C. 2**

The Institute promotes the study of people in their capacity as workers and their behaviour at work, in order to obtain the maximum of achievement and the minimum of stress. Lectures, discussion groups, conferences and instructional courses are organized in London and the provincial cities. A library and a consultative service is maintained. Membership is open to individuals and to corporate bodies. The Institute publishes two journals: one, *Occupational Psychology*, is a scientific quarterly; the other, *Psychology at Work*, is published every two months and is designed to appeal to those who are interested in the application of industrial psychology, but who are not specialists in the subject.

**National Marriage Guidance Council, 78 Duke Street, Grosvenor Square, London, W. 1**

The Marriage Guidance Council has established throughout the country about a hundred local Councils, which give advice to engaged couples and provide help in marriage troubles of all kinds. Educational work is undertaken through lectures and conferences. The Council supplies selected literature and issues the monthly journal, *Marriage Guidance*.

**National Society for Epileptics, Chalfont Colony, Chalfont St. Peter, Buckinghamshire**

The objects of this Society are to establish and maintain Homes on the Colony system for persons suffering from epilepsy and to promote the welfare of epileptics generally.

**Neuropsychiatric Research Centre, Whitchurch Hospital, Cardiff**

The Research Centre has liaison with the University of Wales and the Welsh National School of Medicine. Research is carried out on fundamental and on clinical problems related to the nervous system and there are laboratories for biochemical, electrophysiological and psychological work. There is a department for electroencephalographic investigation and research. Appropriate facilities are available for those working for the Ph.D. and other higher degrees.

**New Education Fellowship, 1 Park Crescent, London, W. 1**

The Fellowship is a world movement organized in self-governing national sections. Its aim is to promote the exchange and practice of ideas that strengthen the educational foundations of peace. Activities include international conferences, study courses, the publication of an international educational magazine, *The New Era*, and publication of books by the New Education Book Club.

**Nursery School Association of Great Britain and Ireland, 1 Park Crescent, London, W. 1**

The Association is concerned with all aspects of the work of nursery schools. It supplies literature and films; it organizes conferences, meetings and summer schools, on subjects connected with the education and care of children up to 7 years of age.

**Provisional National Council for Mental Health**

The Council was formed in 1943 by the following three bodies, as a first step towards their amalgamation: (i) the Central Association for Mental Welfare; (ii) the Child Guidance Council, and (iii) the National Council for Mental Hygiene. This was completed in 1946 and the Council is now known as the National Association for Mental Health, *q.v.*

**Rationalist Press Association, 5 & 6 Johnson's Court, Fleet Street, London, E.C. 4**

The Association is concerned with maintaining a healthy mental outlook in the community, by promoting the publication of books and periodicals of educational value. Publications include the Thinker's Library series. Public meetings and conferences are organized.

**Roffey Park Rehabilitation Centre, Horsham, Surrey**

The Centre provides psychiatric treatment and resettlement facilities for patients who are referred by psychiatric out-patient departments and by industrial medical officers. All forms of modern psychiatric treatment are available and special attention is paid to placement on discharge. The Centre is supported by the National Council for the Rehabilitation of Industrial Workers.

**Royal Medico-Psychological Association, 11 Chandos Street, Cavendish Square, London, W. 1**

The Association is the chief medical organization concerned with psychiatry in Great Britain. Activities include the arrangement of scientific and clinical meetings in London and the provinces, as well as study tours abroad. Separate meetings are held in the South-Eastern, South-Western, Northern and Midland, Scottish and Irish divisions. Papers are read at meetings of the Research and Clinical, Mental Deficiency, Psychotherapy and Social Psychiatry, and Child Psychiatry

Sections. The work of the Association is carried out by a number of committees and subcommittees. Examinations for the Diploma in Psychological Medicine and the Mental Nursing Certificates are conducted. The Association publishes the *Journal of Mental Science*, the *Handbook for mental nurses*, *Recent progress in psychiatry* and other publications.

**Royal Society of Medicine : Section of Psychiatry, 1 Wimpole Street, London, W. 1**

Meetings are held at which papers are read and matters of scientific and clinical interest are discussed. Papers are published in the *Proceedings of the Royal Society of Medicine*. The library contains a very full collection of psychiatric journals and books. Visitors can be admitted to meetings only on the introduction of a member of the Section. The library is private to Fellows, but visitors can be admitted if sponsored by a Fellow.

**Scottish Association for Mental Health, 41 Charlotte Square, Edinburgh, 2**

**Scottish Council for Health Education, 3 Castle Street, Edinburgh, 2**

The objects of the Scottish Council are to promote and encourage education in the science and art of healthy living and in the principles of hygiene, by the dissemination of knowledge about health among the general public of all ages. The Council acts in close co-operation with the major local authorities in the promotion of health lectures, with films, in cities and towns throughout Scotland, and in the organization of "health weeks" and exhibitions and annual summer schools in health education. The Council also produces a wide range of literature on many aspects of health.

**Society of Analytical Psychology, Limited, 32 Carlton Hill, St. John's Wood, London, N.W. 8**

This Society undertakes the training of medical and non-medical analysts according to the principles of Jungian psychology. Acceptance for training depends on personal suitability and academic qualifications. Duration of training varies with individual need, but a minimum of three years' personal analysis is required.

**Society for the Study of Inebriety, Alcoholism and Drug Addiction, c/o Westminster Hospital, London, S.W. 1**

The Society holds quarterly discussions and issues the *British Journal of Addiction*. Research on relevant problems is promoted.

**Tavistock Clinic, 2 Beaumont Street, London, W. 1**

Provision is made for out-patient psychotherapy for adults and children. Individual and group methods are used, and research and training in this field are carried out.

**Tavistock Institute of Human Relations, 2 Beaumont Street, London, W. 1**

The aim of the Institute is to advance scientific knowledge of human affairs and to facilitate the application of such knowledge to the solution of practical problems. Its activities comprise therapeutic services to the community and research in family, educational, industrial and other fields. The basis of its work is medical, but it attempts to integrate all branches of social science.

**Usher Institute, Warrender Park Road, Edinburgh, 9**

The Institute is concerned with the study of social problems, including those related to mental health.

**Village Centres Council (Enham-Alamein Village Centre, Andover, Hants.), 16 Grosvenor Place, London, S.W. 1**

The object of the Council is to aid the restoration in mind and body of those disabled by war or sickness, accident, etc. This work of rehabilitation comprises the following activities: (i) the provision of medical treatment; (ii) where necessary, the provision of training in a suitable occupation; (iii) the offer of permanent medically-protected employment in the industries established at Enham, and (iv) where financially possible, the provision of homes in healthy surroundings for the disabled and their families.

**West of Scotland Neuro-Psychiatric Research Institute, 10 Shelley Road, Glasgow, W. 2**

The Institute is engaged in research on the pathology and treatment of mental disease. Work is in progress on the serodiagnosis of syphilis, on immunology and on blood changes in mental disorders.

**World Federation for Mental Health : British Branch, 19 Manchester Street, London, W. 1**

The purposes of the Federation include the co-ordination of the activities of governmental and professional organizations concerned with the promotion of mental health. The Federation publishes the *Bulletin of the World Federation for Mental Health*.

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# MENTAL HEALTH

## A Bibliography of British Books and Periodicals

T. F. HOWARTH

Sub-Librarian, British Medical Association

The study of the mind and its disorders was for many years considered to be within the sphere of the psychiatrist and specialist only, but today a knowledge of psychological medicine has become an essential part of general practice and social welfare.

In compiling this bibliography an attempt has been made to include literature which will be of value not only to the specialist, but to the general practitioner and all others having an interest in mental health.

As will be seen from the list, the number of British periodicals relating to mental health is comparatively small, but articles on this specialty appear from time to time in most of the leading medical journals published in Great Britain.

## A. PERIODICALS

Information given includes name of publication, frequency of appearance, place of publication, name of publisher and amount of subscription, which is annual unless otherwise indicated.

*Archives of Neurology and Psychiatry from the Central Pathological Laboratory and the Maudsley Hospital, Denmark Hill, London and the London County Hospitals for Nervous and Mental Diseases.* Irregular. London: London County Council. Price variable.

Reprints of articles by members of the staff of the various London County Council mental hospitals and laboratories.

*Brain. A Journal of Neurology.* Quarterly. London: Macmillan. 34s. [£1.7]

Original neurological research: notices of recent publications.

*British Journal of Educational Psychology.* Three times a year. London: Methuen. 20s. [£1.0]

Issued by the British Psychological Society and the Association of Teachers in Colleges and Departments of Education. Original articles, book reviews.

*British Journal of Medical Psychology.* Quarterly. London: Cambridge University Press. 40s. [£2.0]

Medical section of the *British Journal of Psychology*. Original articles.

*British Journal of Psychiatric Social Work.* Irregular. London: Association of Psychiatric Social Workers. Price variable.

New journal for social workers.

*British Journal of Psychology (General Section).* Quarterly. London: Cambridge University Press. 40s. [£2.0]

Issued by the British Psychological Society.

*British Journal of Psychology (Statistical Section).* Irregular. London: University of London Press. 30s. [£1.5]

*Bulletin of the World Federation for Mental Health.* Every two months. London: World Federation for Mental Health. 5s. [£0.25]

New publication.

*Howard Journal. A Review of Modern Methods for the Prevention and Treatment of Crime and Juvenile Delinquency.* Irregular. London: Howard League for Penal Reform. 1s. per copy. [£0.05]

*Human Relations.* Quarterly. London: Tavistock Institute of Human Relations. 35s. [£1.75]

Studies towards the integration of social sciences. Contributions on social psychology.

*International Journal of Psycho-Analysis.* Quarterly. London: Baillière. 40s. [£2.0]

Official organ of the International Psycho-Analytical Association. Original papers, abstracts of international psychoanalytical literature, and book reviews.

*Journal of Mental Science.* Quarterly. London: Churchill. 50s. [£2.5]

Official publication of the Royal Medico-Psychological Association, devoted to psychiatry. Contains bibliography and epitome of international literature and book reviews.

*Journal of Neurology, Neurosurgery and Psychiatry.* Quarterly. London: British Medical Association. 25s. [£1.25]

Original contributions. Book reviews.

*Mental Health.* Quarterly. London: National Association for Mental Health. 5s. [£0.25]

Articles on the various aspects of mental health. News and notes. Book reviews. Lists of recent publications.

*Occupational Psychology.* Quarterly. London: National Institute of Industrial Psychology. 20s. [£1.0]

Articles on application of psychology to educational and industrial problems. Book reviews. Abstracts of articles, and reports.

*Quarterly Journal of Experimental Psychology.* Quarterly. Cambridge: Hefter. 30s. [£1.5]

New journal. Organ of the Experimental Psychology Group. Book reviews. Group proceedings.

## B. BOOKS

This list comprises books published in Great Britain in 1947 or later years. Owing to restrictions on space, the list is limited, and the data given include author's name, title of the book, edition, date and place of publication, publisher, price, whether illustrated or containing a bibliography.

### 1. General Works

Blacker, C. P. *Neurosis and the mental health services.* 1946, London: Oxford University Press. 21s. [£1.05]

Proposals, made before the provisions of the National Health Act came into force, for the organization of a mental health service in England and Wales.

Brown, J. A. C. *The distressed mind.* 2nd ed., 1949, London: Watts. 2s. 6d. [£0.125]

Presents in simple language the difficulties which are a handicap to mental health.

Culpin, M. *Mental abnormality. Facts and theories.* 1948, London: Hutchinson. 7s. 6d. [£0.375] Bibliography.

Intended mainly for the intelligent layman.

Ewen, J. H. *Mental health. A practical guide to disorders of the mind.* (With a chapter on special treatments and their practical technique, by C. Friedman.) 1947, London: Arnold. 12s. 6d. [£0.625] Bibliography.

A concise account of the salient features of mental illness.

Feversham Committee. *The voluntary mental health services. The report of the Feversham Committee.* 1939, London: Feversham Committee. 2s. 6d. [£0.125]

Guttmann, E. & Thomas, E. L. *On the re-adjustment in civil life of soldiers discharged from the Army on account of neurosis.* (Ministry of Health Report No. 93.) 1946, London: His Majesty's Stationery Office. 1s. 3d. [£0.0625]

Halliday, J. L. *Psychosocial medicine. A study of the sick society.* 1949, London: Heinemann. 17s. 6d. [£0.875]

*International Congress on Mental Health, London 1948.* 1949: London, Lewis.

Vol. I. History, development and organisation. 10s. [£0.5]

„ II. Proceedings of the International Conference on Child Psychiatry, 11th-14th August. 10s. [£0.5]

- Vol. III. Proceedings of the International Conference on Medical Psychotherapy, 11th-14th August. 10s. [£0.5]
- „ IV. Proceedings of the International Conference on Mental Hygiene, 16th-21st August. 20s. [£1.0]
- London County Council. *Handbook on mental health social work*. 1947, London: London County Council. 2s. 6d. [£0.125]
- Mackintosh, J. M. *The war and mental health in England*. 1944, London: Oxford University Press. 5s. 6d. [£0.275]  
Deals in non-technical language with mental health in England during the Second World War.
- Matthews, F. B. *Mental health services. A handbook on lunacy, mental treatment and mental deficiency*. 1948, London: Shaw. 35s. [£1.75]  
Written as a handbook for those engaged in the administration of the Lunacy and Mental Treatment Acts and the Mental Deficiency Acts under the National Health Service.
- Moore, D. T. V. *Personal mental hygiene*. 1947, London: Heinemann. 21s. [£1.05]  
Intended primarily for the individual confronted with the difficulties of life.
- Neill, A. S. *The problem family*. 1949, London: Jenkins. 7s. 6d. [£0.375]  
Psychological problems of family life.
- Preston, G. H. *The substance of mental health*. 1944, London: Jarrold. 3s. 6d. [£0.175]  
For parents and teachers.
- White, H. D. J. *Guide to mental health*. 1939, London: Daniel. 15s. [£0.75]
- ## 2. Child Psychology
- Allen, F. H. *Psychotherapy with children*. 1947, London: Kegan Paul. 10s. 6d. [£0.525]  
Author's experience of a child guidance clinic.
- Aris, N. *Parents and children*. 1940, London: Stanley Paul. 5s. [£0.25] Illustrated.  
For parents and social workers.
- Bowley, A. H. *Everyday problems of the school child*. 1948, Edinburgh: Livingstone. 7s. 6d. [£0.375] Illustrated.  
For doctors, parents and teachers.
- Bowley, A. H. *Modern child psychology*. 1949, London: Hutchinson. 7s. 6d. [£0.375]  
A non-technical account of child psychology suitable especially for students and teachers.
- Bowley, A. H. *The problems of family life. An environmental study*. 2nd ed., 1947, Edinburgh: Livingstone. 6s. [£0.3] Illustrated.  
Useful little volume on child psychology. Of value to parents.
- Braithwaite, E. W. *Parent and child*. 1939, London: Nelson. 2s. 6d. [£0.125]
- Bühler, C. et al. *The child and his family*. (Translated by Beaumont, H.) 1940, London: Kegan Paul. 10s. 6d. [£0.525]
- Burbury, W. M., Balint, E. M. & Yapp, B. J. *An introduction to child guidance*. 1946, London: Macmillan. 7s. 6d. [£0.375]
- Cameron, H. C. *The nervous child*. 5th ed., 1946, London: Geoffrey Cumberlege. 10s. 6d. [£0.525] Plates.  
Nervous disorders of infancy and childhood and their management.
- Child Guidance Council. *Bibliography of child psychology, 1928-1938*. 1939, London: Child Guidance Council. 1s. [£0.05]
- Fordham, M. *The life of childhood. A contribution to analytical psychology*. 1944, London: Kegan Paul. 15s. [£0.75] Illustrated.
- Gordon, R. G., ed. *Survey of child psychiatry. A contribution by contemporary British authorities*. (Edited on behalf of the Child Guidance Council.) 1939, London: Oxford University Press. 10s. 6d. [£0.525]
- Hall, M. B. *Psychiatric examination of the school child*. 1947, London: Arnold. 15s. [£0.75] Bibliography.  
Written primarily for the medical practitioner, but also useful to social workers.
- Hicklin, M. *War-damaged children. Some aspects of recovery*. 1947, London: Association of Psychiatric Social Workers. 1s. 6d. [£0.075]
- Isaacs, S. *Childhood and after. Some essays and clinical studies*. 1948, London: Routledge & Kegan Paul. 15s. [£0.75]
- Isaacs, S. *Troubles of children and parents*. 1948, London: Methuen. 8s. 6d. [£0.425]  
Child guidance for parents and nurses.
- Ladell, R. M. *The first five years from birth to school. How to help your child to develop its personality*. 1939, London: Psychologist. 1s. [£0.05]  
Small book on child psychology for all who deal with children.
- Moodie, W. *Child guidance*. 1947, London: Cassell. 4s. 6d. [£0.225]  
Essentially for the doctor, but of interest and value to the layman.
- Moodie, W. *The doctor and the difficult child*. 2nd ed., 1947, London: Geoffrey Cumberlege. 11s. 6d. [£0.525]
- Reiss, S. *Mental readjustment*. 1949, London: Allen & Unwin. 10s. 6d. [£0.525]  
Child psychology and psychotherapy of special interest to parents and teachers of young children.
- Valentine, C. W. *The psychology of early childhood. A study of mental development in the first years of life*. 3rd ed., 1946, London: Methuen. 22s. 6d. [£1.125]
- Williams, J. G. *The psychology of childhood to maturity*. 1946, London: Heinemann. 8s. 6d. [£0.425]  
Mainly for parents, teachers and social workers.
- ## 3. Neurology
- Biggart, J. H. *Pathology of the nervous system. A student's introduction*. 2nd ed., 1949, Edinburgh: Livingstone. 21s. [£1.05] Illustrated.
- Blackwood, W., Dodds, T. C. & Somerville, J. C. *Atlas of neuropathology*. 1949, Edinburgh: Livingstone. 35s. [£1.75] Illustrated.
- Brain, W. R. *Diseases of the nervous system*. 3rd ed., 1947, London: Geoffrey Cumberlege. 37s. 6d. [£1.875] Illustrated.  
A standard textbook on nervous diseases.
- Brain, W. R. & Strauss, E. B. *Recent advances in neurology and neuropsychiatry*. 5th ed., 1945, London: Churchill. 18s. [£0.9] Illustrated. Bibliography.
- Hern, K. M. *Physical treatment of injuries of the brain and allied nervous disorders*. 1947, London: Baillière. 10s. 6d. [£0.525] Illustrated.
- Holmes, G. *Introduction to clinical neurology*. 1946, Edinburgh: Livingstone. 12s. 6d. [£0.625] Illustrated.  
An introduction to the study of disorders of the nervous system.
- Monrad-Krohn, G. H. *The clinical examination of the nervous system*. 9th ed., 1948, London: Lewis. 16s. [£0.8]  
A standard work on examination of the nervous system.
- Purves-Stewart, J. *The diagnosis of nervous diseases*. 9th ed., 1945, London: Arnold. 40s. [£2.0] Illustrated.  
A standard textbook by a leading authority on nervous diseases.
- Sherrington, C. *The integrative action of the nervous system. With a new foreword by the author and a bibliography of his writings*. 1947, Cambridge: University Press. 25s. [£1.25] Illustrated. Bibliography.  
A standard work on the physiology of the nervous system.
- Spillane, J. D. *Nutritional disorders of the nervous system*. 1947, Edinburgh: Livingstone. 20s. [£1.0] Illustrated. Bibliography.

Walshe, F. M. R. *Critical studies in neurology*. 1948, Edinburgh: Livingstone. 15s. [£0.75] Illustrated.

Walshe, F. M. R. *Diseases of the nervous system. Described for practitioners and students*. 6th ed., 1949, Edinburgh: Livingstone. 17s. 6d. [£0.875] Illustrated.

A recognized textbook on diseases of the nervous system.

Wilson, S. A. K. *Neurology*. Edited by A. Ninian Bruce. Vols. 1, 2, 1940, London: Arnold. 84s. [£4.2] Illustrated.

A detailed treatise on neurology.

#### 4. Psychiatry

Beccle, H. C. *Psychiatry, theory and practice. For students and nurses*. 2nd ed., 1948, London: Faber & Faber. 10s. 6d. [£0.525] Illustrated.

Board of Control (England and Wales). *Pre-frontal leucotomy in a thousand cases*. 1947, London: His Majesty's Stationery Office. 6d. [£0.025]

Report on the results of prefrontal leucotomy in the treatment of mental disorder.

Bowlby, J. *Personality and mental illness. An essay in psychiatric diagnosis*. 1940, London: Kegan Paul. 10s. 6d. [£0.525] Bibliography.

Curran, D. & Guttmann, E. *Psychological medicine. A short introduction to psychiatry with an appendix on psychiatry associated with war conditions*. 3rd ed., 1949, Edinburgh: Livingstone. 12s. 6d. [£0.625] Illustrated. Bibliography.

Dawson, W. S. *Aids to psychiatry*. 5th ed., 1944, London: Baillière. 6s. [£0.3]

Students' Aids Series.

Eager, R. *The treatment of mental disorders (ancient and modern)*. 1945, Exeter: W. V. Cole & Sons. 7s. 6d. [£0.375] Illustrated.

A short history of the treatment of mental disorders.

Harris, N. G., ed. *Modern trends in psychological medicine*. 1948, London: Butterworth. 50s. [£2.5] Illustrated. Bibliography.

Collection of papers by leading authorities on psychological medicine.

Henderson, D. K. & Gillespie, R. D. *A textbook of psychiatry for students and practitioners*. 6th ed., 1944, London: Oxford University Press. 25s. [£1.25] Bibliography.

A standard textbook.

Hill, H. *The histamine and insulin treatment of schizophrenia and other mental diseases*. 1940, London: Baillière. 6s. [£0.3]

Home Office. *Report of the psychological treatment of crime*. By W. Norwood East & W. H. de B. Hubert. 1939, London: His Majesty's Stationery Office. 2s. 6d. [£0.125]

Report on the investigation carried out at Wormwood Scrubs Prison to ascertain the value of psychological treatment in the prevention and cure of crime.

Ironside, R. N. & Batchelor, I. R. C. *Aviation neuro-psychiatry*. 1945, Edinburgh: Livingstone. 8s. 6d. [£0.425]

Of interest and value to medical officers of the RAF and others concerned with flying personnel.

Jessner, L. & Ryan, V. G. *Shock treatment in psychiatry. A manual*. 1942, London: Heinemann. 17s. 6d. [£0.875] Bibliography.

Brief, practical review of the various shock treatments.

Kalinowsky, L. B. & Hoch, P. H. *Shock treatments and other somatic procedures in psychiatry*. 1946, London: Heinemann. 21s. [£1.05] Bibliography.

Miller, E., ed. *The neuroses in war*. 1940, London: Macmillan. 10s. 6d. [£0.525] Bibliography.

Contains papers by several authors on mental problems associated with war.

Minski, L. *A practical handbook of psychiatry for students and nurses*. 1946, London: Heinemann. 6s. [£0.3]

Moncrieff, A., ed. *Psychology in general practice*. 1945, London: Eyre & Spottiswoode. 12s. 6d. [£0.625]

Papers by various authors.

Moodie, W. *The doctor and the difficult adult*. 1947, London: Cassell. 15s. [£0.75]

Written for the practitioner who wishes more fully to understand the many peculiar persons he meets in everyday practice.

Murray, J. B. *Some common psychosomatic manifestations*. 1949, London: Geoffrey Cumberlege. 7s. 6d. [£0.375] Illustrated. Bibliography.

Neustatter, W. L. *The early treatment of nervous and mental diseases*. 1940, London: Churchill. 15s. [£0.75] Bibliography.

Neustatter, W. L. *Modern psychiatry in practice*. 2nd ed., 1948, London: Churchill. 12s. 6d. [£0.625]

Psychiatric problems as presented in the consulting room, ward and out-patient department.

Nicole, J. E. *Normal and abnormal psychology. A précis for junior students, nurses, occupational therapists, welfare workers and others*. 1948, London: Allen & Unwin. 8s. 6d. [£0.425]

Nicole, J. E. *Psychopathology. A survey of modern approaches*. 4th ed., 1946, London: Baillière. 15s. [£0.75] Bibliography.

Designed to provide a general survey of the views of the different schools of psychiatry of today.

O'Connor, W. A. *Psychiatry. A short treatise*. 1948, Bristol: Wright, 35s. [£1.75]

Rees, J. R. *The shaping of psychiatry by war*. 1945, London: Chapman & Hall. 10s. 6d. [£0.525]

Ross, T. A. *Lectures on war neuroses*. 1941, London: Arnold. 6s. [£0.3]

A small volume on the effects of war on mental health.

Rudolf, G. de M., ed. *The psychological aspects of delinquency. A series of lectures*. 1939, London: Baillière. 2s. 6d. [£0.125]

Sargant, W. & Slater, E. *An introduction to physical methods of treatment in psychiatry*. With a chapter on treatment of the epilepsies, by Denis Hill. 2nd ed., 1948, Edinburgh: Livingstone. 10s. 6d. [£0.525] Bibliography.

Skinner, E. F. *An outline of medical psychology*. 1939, London: Lewis. 6s. [£0.3]

Useful to medical students studying psychological medicine.

Soddy, K. *Some lessons of war-time psychiatry*. 1948, London: National Association for Mental Health. 1s. [£0.05]

Tredgold, A. F. *Manual of psychological medicine. For practitioners and students*. 2nd ed. (reprint), 1946, London: Baillière. 18s. [£0.9] Bibliography.

Tredgold, A. F. *A text-book of mental deficiency (amentia)*. 7th ed., 1947, London: Baillière. 30s. [£1.5] Illustrated.

A standard work on mental deficiency.

Wall, C. W. *The value of neurosis*. 1948, London: Rylee. 8s. 6d. [£0.425] Illustrated.

Wexberg, L. E. *Introduction to medical psychology*. 1948, London: Heinemann. 17s. 6d. [£0.875]

For the physician and student.

#### 5. Psychoanalysis

Berg, C. *Clinical psychology. A case book of the neuroses and their treatment*. 1948, London: Allen & Unwin. 25s. [£1.25]

Berg, C. *Deep analysis. The clinical study of an individual case*. 1946, London: Allen & Unwin. 12s. 6d. [£0.625]

Berg, C. *War in the mind. The case book of a medical psychologist. An introduction to the practical application of modern psychology*. 2nd ed., 1944 (reprinted 1946), London: Macaulay Press. 10s. 6d. [£0.525]

Faithfull, T. *A handbook of self-analysis*. 1948, London: Rylee. 8s. 6d. [£0.425] Illustrated.

Flugel, J. C. *Man, morals and society. A psycho-analytical study*. 1945, London: Duckworth. 21s. [£1.05]

Freud, S. *An outline of psycho-analysis*. Authorized translation by James Strachey. 1949, London: Hogarth Press. 8s. 6d. [£0.425]

Freud's last major work.

Glover, E. *Psycho-analysis. A handbook for medical practitioners and students of comparative psychology*. 2nd ed., 1949, London: Staples Press. 15s. [£0.75]

Glover, E. & Brierley, M. F. E. *An investigation of the technique of psycho-analysis*. 1940, London: Baillière. 10s. 6d. [£0.525]

Horney, K. *New ways in psychoanalysis*. 1949, London: Kegan Paul. 18s. [£0.9]

Horney, K. *Our inner conflicts. A constructive theory of neurosis*. 1946, London: Kegan Paul. 10s. 6d. [£0.525]

Jones, E. *Papers on psycho-analysis*. 5th ed., 1948, London: Baillière. 31s. 6d. [£1.575]

A classical work on psychoanalysis.

## 6. Psychology

Adler, A. *Guiding human misfits. A practical application of individual psychology*. 2nd ed., 1948, London: Faber & Faber. 7s. 6d. [£0.375]

Adler, G. *Studies in analytical psychology*. 1948, London: Routledge & Kegan Paul. 21s. [£1.05] Illustrated.

Bartlett, F. C., Ginsberg, M., Lindgren, E. J. & Thouless, R. H., ed. *The study of society. Methods and problems*. 1939, London: Kegan Paul. 10s. 6d. [£0.525]

A study of social psychology.

Brend, W. A. *Foundations of human conflicts. A study in group psychology*. 1944, London: Chapman & Hall. 15s. [£0.75]

Brown, W. *Oxford essays on psychology*. 1948, London: Heinemann. 10s. 6d. [£0.525]

Primarily intended for the intelligent layman.

Ewen, J. H. *Aids to psychology*. 3rd ed., 1948, London: Baillière. 5s. [£0.25]

Students' Aids Series.

Jung, C. G. *The integration of the personality*. Translated by Stanley M. Dell. 1940, London: Kegan Paul. 15s. [£0.75] Illustrated.

Leahy, M. P. *Fear*. 1948, London: Research Books Ltd. 10s. 6d. [£0.525]

Explains in everyday language what fear is and how this condition of the mind can be successfully treated.

Lowy, S. *Man and his fellowman. Modern chapters on social psychology*. 1944, London: Kegan Paul. 15s. [£0.75]

MacCurdy, J. T. *The structure of morale*. 1943, Cambridge: University Press. 8s. 6d. [£0.425]

McDowall, R. J. S. *Sane psychology. A biological introduction to psychology*. 2nd ed., 1943, London: Murray. 9s. [£0.45] Bibliography.

Mackenzie, M. *The human mind. The organ of thought in function and dysfunction*. 1941, London: Churchill. 7s. 6d. [£0.375]

Valentine, C. W. *Psychology and mental health*. 1948, London: Methuen. 4s. [£0.2] Bibliography.

West, R. *Conscience and society. A study of the psychological prerequisites of law and order*. 1942, London: Methuen. 15s. [£0.75]

Woodworth, R. S. *Psychology*. 19th ed., 1948, London: Methuen. 12s. 6d. [£0.625] Illustrated. Bibliography.

A standard work of value to students.

Young, K. *Handbook of social psychology*. 1946, London: Kegan Paul. 21s. [£1.05]

## 7. Psychotherapy

Allison, D. R. & Gordon, R. G. *Psychotherapy. Its uses and limitations*. 1948, London: Geoffrey Cumberlege. 8s. 6d. [£0.425]

Brown, W. *Psychology and psychotherapy*. 5th ed., 1944, London: Arnold. 14s. [£0.7] Bibliography.

Dicks, H. V. *Clinical studies in psychopathology. A contribution to the aetiology of neurotic illness*. 2nd ed., 1947, London: Arnold. 15s. [£0.75]

Fink, D. H. *Release from nervous tension*. 1945, London: Allen & Unwin. 8s. 6d. [£0.425]

The author's method of treating nervous tension by relaxation.

Gregory, M. *Psychotherapy: scientific and religious*. 1939, London: Macmillan. 21s. [£1.05] Bibliography.

Harris, N. *Modern psychotherapy*. 1939, London: Bale. 7s. 6d. [£0.375] Bibliography.

Herzberg, A. *Active psychotherapy*. 1945, London: Research Books Ltd. 12s. 6d. [£0.625]

Horsley, J. S. *Narco-analysis. A technique in short-cut psychotherapy: a comparison with other methods and notes on barbiturates*. 1943, London: Oxford University Press. 8s. 6d. [£0.425] Bibliography.

Klapman, J. W. *Group psychotherapy. Theory and practice*. 1946, London: Heinemann. 21s. [£1.05] Bibliography.

Rippon, T. S. & Fletcher, P. *Reassurance and relaxation. A short textbook of practical psychotherapy describing the nature of anxiety and how to induce relaxation in the nervous patient*. 1940, London: Routledge. 6s. [£0.3]

Slavson, S. R., ed. *The practice of group therapy*. 1947, London: Pushkin Press. 21s. [£1.05]

Of value to practitioners and those working in the field of mental health.

Stekel, W. *Technique of analytical psychotherapy*. Translated by Eden & Cedar Paul. 1939, London: Bodley Head. 21s. [£1.05]

Wolberg, L. R. *Hypnoanalysis*. 1946, London: Heinemann. 21s. [£1.05]

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# Notes on Contributors

MISS RUTH DARWIN was for many years engaged as a worker in the field of mental health. From 1932 until 1949 she has been Senior Commissioner of the Board of Control. Miss Darwin was awarded the C.B.E. in 1938 in recognition of her services.

MISS OLIVE F. GRIFFITH was trained in general and mental nursing, and holds the certificate of the Florence Nightingale International Foundation in Hospital and Training School Administration. She has held administrative posts in mental hospitals, was Psychiatric Nursing Consultant to the UNRRA Mission to Greece, and until recently was an inspector of training schools for the General Nursing Council. She has now taken up an appointment in Canada.

MR. T. F. HOWARTH has been a member of the staff of the British Medical Association Library since 1927, and has held the position of Sub-Librarian since 1939.

MISS ISABEL M. LAIRD is a psychologist and teacher working independently in the field of preventive mental health. She is experienced in schoolwork with normal and educationally handicapped pupils of all ages, and was for some years headmistress of the special school at the Royal Scottish National Institution, Stirlingshire. During the war Miss Laird was an Inspector under the Board of Control (England and Wales), and was for a time seconded from this post for field-work for a national survey of the incidence of neurosis in the civilian population, which was begun in 1942. She is a Member of the College of Special School Teachers, a Fellow of the British Psychological Society and a former Fellow in Psychology at the London Child Guidance Clinic. She is also Chairman of the Association of Mental Health Workers, a member of the Scottish Advisory Council on Child Care, and a substitute-member of the Executive Board of the World Federation for Mental Health.

PROFESSOR AUBREY LEWIS is an Australian who qualified in Adelaide and, after psychiatric study in the USA and Germany, became attached to the Maudsley Hospital, now a teaching school of the University of London. He now holds the Chair of

Psychiatry in the University and is Director of the Professorial Unit of the Bethlem Royal and Maudsley Hospitals. He is also Honorary Director of the Medical Research Council Occupational Psychiatry Research Unit. His personal views on postgraduate education in psychiatry were set out in an article entitled "Education of Psychiatrists" (*Lancet*, 1947, 2, 79). He has previously contributed to the Bulletin an article entitled "On the Place of Physical Treatment in Psychiatry" (*Brit. med. Bull.*, 1945, 3, 22), with which a more detailed note on his early career was published.

PROFESSOR D. R. MACCALMAN was formerly Crombie-Ross Professor of Mental Health, University of Aberdeen, and in 1948 became Nuffield Professor of Psychiatry at the University of Leeds and Consultant Psychiatric Advisor to the Leeds City Council. He is a Fellow of the British Psychological Society and has, throughout his career, been constantly engaged in research work. At Boston Psychopathic Hospital, USA, he assisted in a large-scale scheme of research in the causation of schizophrenia and also worked on the subject of variations in the leucocyte count in response to change of mood. For three years in America and Scotland he worked on the Rorschach Test and its clinical application. In London he was responsible for the co-ordination of all research work done at the child guidance clinics in England and Wales. He is at present working on such research projects as the etiology of disseminated sclerosis, psychological factors in organic disease, methods of training mental health nurses, techniques in presentation of psychiatric material, the influence of archetypes on educability, and the use of group techniques in teaching and examination. He has contributed sections to a number of books and has published articles in various journals.

MISS E. M. MACDONALD is a teaching and founder member of the Association of Occupational Therapists (England). In 1938 she received a grant from the Pilgrim and York Trusts to study the development of occupational therapy in the USA and Canada. On her return she became Principal of the Dorset House School of Occupational Therapy and throughout the war was an organizer of the war-time courses run by the School at the request

of the Ministry of Health. She has now been invited to sit on the committee set up to consider and to make recommendations on the supply and demand, and training and qualifications, of occupational therapists in the National Health Service. With Dr. N. A. Haworth, Miss Macdonald is author of *Theory of occupational therapy* (1947) published by Baillière, Tindall & Cox, London.

DR. W. S. MACLAY is Medical Senior Commissioner of the Board of Control and Physician to the Out-patient Department of the Maudsley Hospital. After qualifying from Cambridge and St. Bartholomew's Hospital in 1927 he held various appointments in medicine, surgery and other specialties until 1931, when he took up full-time work in psychiatry. He worked at the Maudsley Hospital from 1931 to 1939 and, in addition, from 1938 to 1945 was Physician in Charge of the Department of Psychological Medicine at the West London Hospital. From 1939 to 1945 he was Medical Superintendent of Mill Hill Emergency Hospital which, along with Sutton Emergency Hospital, replaced the Maudsley Hospital during the war years. He is Vice-President of the Psychiatric Section of the Royal Society of Medicine.

DR. DEREK RICHTER has previously contributed to the Bulletin an article entitled "Somatic Aspects of Mental Health and Disease" (*Brit. med. Bull.*, 1949, 6, 44) with which a note on his work was published.

DR. KENNETH SODDY is Assistant Physician in the Department of Psychological Medicine, University College Hospital, and Psychiatrist to the Child Guidance Training Centre. Until recently he was Medical Director of the National Association for Mental Health, and in this capacity was intimately connected with recent developments in social work in the mental health field. During the war he was the senior technical member of a mission sent to India to establish modern scientific selection methods in the three fighting Services and in the Indian Civil Service. In this project he gained valuable experience in methods of intelligence, aptitude, and personality assessment of many races of widely different levels of culture and education.

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**I**N this issue of the Bulletin the arrangement of Part II has been altered; the books reviewed have been classified into a number of main sections which are listed below. Some of the sections are introduced by an article on recent developments in the field or by an essay-review drawing attention to the most important or useful publication received by us during the period covered by this issue. It is hoped that this new plan will facilitate reference to Part II by specialist readers, and that continuity of interest in the various fields of medicine will be maintained. There are, as before, sections devoted to shorter notices, historical notes, film reviews, and a guide to the contents of current British medical periodicals.

## Annotations & News

Medical congresses 1950—Medical Research Council—Royal Society Medal awards—World Health Organization: a plan for mental health—The first year of the National Health Service—British Commonwealth collections of micro-organisms—A German-English medical dictionary—New journals—Journals newly received.

## Historical Notes

A NOTE ON BRITAIN'S CONTRIBUTION TO MENTAL NURSING ... *Laurence Dopson*  
JAMES COWLES PRICHARD AND "MORAL INSANITY" ... *Laurence Dopson*  
SIR GILBERT BLANE 1749-1834 ... *F. A. Tubbs*  
VESALIUS: ANATOMIST (1514-1564) ... *R. Paramore*  
MEDICINE IN THE WESTERN WORLD ... *S. S. B. Gilder*

## Book Reviews

### MEDICINE:

A DUBLIN SCHOOL OF MEDICINE AND SURGERY ... *J. H. Young*  
Pulmonary tuberculosis—Tuberculosis in young adults—Medicine—Medical treatment—Médecine pratique—BMA meeting, 1948—Clinical endocrinology—Practice of endocrinology—Sterility and impaired fertility—Sexual disorders in the male—Rheumatism research centre—Le rhumatisme chronique dégénératif—Skin diseases—Nutritional anaemia—Grundlagen der Allergie—Essentials of fevers—Cancer: radiotherapy in Britain—Les hématodermies—Photography: radiographic and clinical.

### SURGERY:

OPHTHALMOLOGY: A DEFINITIVE ACCOUNT ... *W. J. B. Riddell*  
Modern surgery—Minor surgery—Handbook of surgery—Surgical treatment: instruments and appliances—Abdominal hernia—Genito-urinary surgery—Recent advances in oto-laryngology—Nose and throat diseases—History of oto-laryngology—Handbook of ophthalmology—Eye diseases—Das Haftglas—Anaesthesia for the poor risk—Recent advances in anaesthesia and analgesia—Manual of practical anatomy—Regional anatomy—Living anatomy—Atlas of head and neck.

### OBSTETRICS & GYNAECOLOGY:

TRAINING AND RECRUITMENT OF MIDWIVES ... *C. Scott Russell*  
Management in obstetrics—Practical obstetrics—Midwifery—Diseases affecting the vulva—Die gynäkologischen Operationen.

### CHILD HEALTH:

NEONATAL MORTALITY ... *Dugald Baird*  
Child and youth welfare—The premature baby—Clinical pediatrics.

## NEUROLOGY & PSYCHIATRY:

Modern medical psychology—Mental deficiency (amentia)—Psychological medicine, 1949—Kinderpsychiatrie.

## TROPICAL MEDICINE:

BRITISH SCHOOLS OF TROPICAL MEDICINE ... *G. M. Findlay*  
Malaria and blackwater fever—Malaria control in West Africa—Trypanosomiasis in Africa—Insects of medical importance.

## SOCIAL MEDICINE:

THE POPULATION PROBLEM ... *Ffrangcon Roberts*  
National Health Service—National Health Service Act, 1946—Public health law—Modern trends in public health—Measurements of public health—Public health—Public health administration in USA—Forensic medicine—Social biology.

## MEDICAL SCIENCES & RESEARCH:

CHEMISTRY OF PENICILLIN ... *James Walker*  
Biological assay—Tuberculose: études chimiques—Streptomycin und Tuberkulose—Air hygiene—Annual review of physiology—Enfermedades del hígado—Fatty liver disease in infants—Kohlhydratstoffwechsel—Haematology: bone-marrow biopsy—Bone-marrow pathology—Sternal puncture—Blood cell production—Embryology and morphology—Embryologie—Eye physiology—Vitamin A requirement—Practical pharmacognosy.

## Shorter Notices

Ventilation and heating—Understand your diabetes—Occupational & physio-therapy—Public health for midwives—Physiotherapy techniques—Pharmacology and therapeutics—Artificial pneumothorax—Pasteurisation—Sulphonamides—Principles of dietetics—Diabetic ABC—National Health Service—Nuffield Foundation report—Anaesthetics and the patient—Textbook for midwives—Foods—Midwifery—Human physiology.

## Books Received

## Films

His fighting chance  
A technique of subcutaneous hormone implantation

## Guide to the Journals

# Annotations & News

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## MEDICAL CONGRESSES 1950

**Anatomy.** The International Anatomical Congress, 1950, will be held in Oxford from 25-28 July. Sections are being planned to include the following subjects: General Anatomy, Histology & Embryology, Morphogenics & Endocrinology, Neurology, and Physical Anthropology. Membership of the Congress is open not only to members of anatomical societies but to persons engaged in research or teaching in the above subjects and working in approved institutions. The Congress organizer is Miss A. M. Mayall, Department of Human Anatomy, University Museum, Oxford.

**Microbiology.** The Fifth International Congress of Microbiology will be held in Rio de Janeiro from 17-24 August, 1950. Further information may be obtained from Dr. H. G. Pereria at the Instituto Oswaldo Cruz, Rio de Janeiro.

**Ophthalmology.** The Sixteenth International Conference of Ophthalmology will be held in London from 17-21 July, 1950. The Conference is organized by the Royal College of Surgeons of England and information may be obtained from the Conference secretary, Mr. Frank W. Law, F.R.C.S., 45 Lincoln's Inn Fields, London, W.C.2.

**Optical Science.** Also in London, the International Meeting for Optical Science will be held from 17-26 July, 1950. The secretary of the conference is Professor L. C. Martin, Imperial College, Exhibition Road, London, S.W.7.

**Paediatrics.** Zurich will be the scene of the Sixth International Congress of Paediatrics. The Congress will be held towards the end of July, 1950, and will last from four to five days. It is proposed to hold two plenary sessions and a series of simultaneous group sessions, together with a scientific exhibition at which the lecturers' graphs, photographs, etc. will be displayed. Professor G. Fanconi is president of the Congress and the secretary-general is Professor Emmett Holt, Bellevue Hospital, New York 16, N.Y.

**Physiology.** The Eighteenth International Physiological Congress will be held in Copenhagen from 15-18 August, 1950. The Congress is intended for members of national physiological, biochemical and pharmacological societies. The organizing secretary is Professor E. Lundsgaard and the Congress Bureau is Zoofysiologisk Laboratorium, Juliane Maries Vej 32, Copenhagen.

**Radiology.** The Sixth International Congress of Radiology will be held in London from 23-29 July, 1950. The headquarters of the Congress will be at the Central Hall, Westminster, S.W.1. In addition to the meetings, there will be a scientific exhibition and a technical exhibition of apparatus. The subjects to be discussed at the General Congress Scientific Meetings are: (i) Radiological Achievement, 1937-1950; (ii) Mass Radiology of the Chest; (iii) Supervoltage Radiotherapy; (iv) Radiation Hazards. In addition, symposia will be held by the Diagnosis Section, Therapy Section, Biology Section and Physics Section. A special programme of social events is also being arranged.

The Conference is open to members of radiological societies and also to technical staffs of radiological departments, and of the x-ray industry. Further information may be obtained from the Faculty of Radiologists, 45 Lincoln's Inn Fields, London, W.C.2.

**Speech Therapy.** The International Association for Logopaedics and Phoniatriy will hold an International Speech Therapy Conference in Amsterdam from 20-26 August, 1950. There will be sessions on the following subjects: (i) Psycho-therapeutic Influence on Speech Diseases; (ii) Change of Voice and Voice Disorders; (iii) Cleft Palate; (iv) Aphasia, Alcxia, etc.; (v) Diction. One day will be devoted to visiting a number of institutions. The secretary of the organizing committee is Dr. Hanny Veldkamp, P. C. Hooftstraat 27, Amsterdam-Z, Netherlands.

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## MEDICAL RESEARCH COUNCIL

Professor H. P. Himsworth has been appointed Secretary of the Medical Research Council as from 1 October, in succession to Sir Edward Mellanby, F.R.S. Professor Himsworth, who is well known for his work on diabetes mellitus and on the liver, is 44 years of age and has had a brilliant career. From 1939 he was Professor of Medicine in the University of London and Director of the Medical Unit, University College Hospital.

1426

## ROYAL SOCIETY MEDAL AWARDS

The Royal Society announces that H.M. the King has approved the award of the two Royal Medals of the Society for the year 1949 to:

SIR GEORGE THOMSON, F.R.S., for his distinguished contributions to many branches of atomic physics.

PROFESSOR R. A. PETERS, M.C., F.R.S., for his distinguished biochemical researches; in particular for his investigations of the biochemical role of vitamin B<sub>1</sub> in tissue metabolism, and the mechanism of the toxic action of lewisite and other arsenical compounds.

Professor Peters has contributed a number of articles to *British Medical Bulletin*, the most recent being one on the "Development and Theoretical Significance of British Anti-Lewisite (BAL)" (*Brit. med. Bull.* 1948, 5, 313).

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## WORLD HEALTH ORGANIZATION A PLAN FOR MENTAL HEALTH

The Constitution of the World Health Organization places upon it specific responsibilities in the field of mental health; member States have undertaken "to foster activities in the field of mental health, especially those affecting the harmony of human relations". WHO plans to meet these responsibilities; at the International Congress on Mental Health held in London in August 1948, a World Federation for Mental Health was set up (*sec Off. Rec. World Hlth Org.* 18, 79). A large number of national organizations is affiliated with this body, which has been admitted to consultative status by WHO and UNESCO.

It is recognized that the need for work in mental health is urgent and world-wide. At this stage, the most pressing need is for factual information and for educative programmes to remedy the most obvious defects in the various schemes for the prevention and treatment of mental disorders; the schemes are at present limited by the scarcity of trained workers. It is proposed, therefore, to undertake a survey to collect data regarding the existing position in different areas, including the extent to which mental health problems have been assessed and provided for. It is planned to form field teams of WHO workers, not only for the carrying out of such a survey, but also for the demonstration of techniques of prevention and treatment.

In the field of education in mental health work, it is planned to make extensive use of WHO teams of field workers, and to direct efforts not only towards the medical and allied professions, but towards the general public. An enlightened public opinion is recognized as a factor of the utmost importance in the solution of mental health problems. The Republic of the Philippines is the first country to avail itself of WHO assistance in mental health matters; the country's resources and needs in this field will be surveyed under the direction of Dr. Krapf, Associate Professor of Psychiatry at the University of Buenos Aires.

D. F.

1428

## THE FIRST YEAR OF THE NATIONAL HEALTH SERVICE

With a commendable lack of delay, the editors of *The Practitioner* have published an extra number devoted entirely to a survey of the first year's working of the National Health Service Act in Great Britain. In view of the well-established position in British medical

<sup>1</sup> *The Practitioner*, extra number; "A Review of the National Health Service Act." Autumn 1949, London. 5s. [£0.25]

journalism which *The Practitioner* enjoys, the reader may expect to find a comprehensive and unbiased presentation, and he will not be disappointed: the issue includes seventeen articles written by representative individuals actively concerned in the Service, who have been selected on the basis of their intimate knowledge of the everyday working of the Service and their freedom from political bias and other prejudice. After much consideration, the editorial decision was that the articles should be anonymous; one reason for this is that several of the contributions were jointly written by two or more authors.

The separate articles present the views of a physician, a surgeon, an obstetrician, and two general practitioners; an ophthalmologist, a dentist, a pharmacist, a medical administrator and two young doctors at the threshold of their medical careers add their views. There are further contributions from a representative of the Ministry of Health, a spokesman for the profession of nursing, and a hospital patient. The presentation is completed by a general article reviewing the first year of the Service, another surveying the Service in Scotland, a final article on the costs of the N.H.S. written by a professional economist, and a useful chart showing the organization of this somewhat complex Service. The net effect of these is to present a well-rounded view of medical practice in Britain during the past year; it is clear that the views of the contributors have been respected. The editorial hand has been restrained, so that a series of individual views rather than a consistent report is the result. This is a matter for congratulation.

It is not surprising, therefore, that fairly sharp differences of opinion are revealed. The physician feels that

there is no evidence that the health of the nation has benefited from the first year of the National Health Service. On the other hand, thanks largely to the integrity of an ancient and honourable profession, no great harm has resulted.

The obstetrician, however, takes the view that

the field is set for a wonderful experiment which could not fail to yield encouraging and possibly dramatic results. . . . The pooled experience of the various regions would tend progressively to up-grade the standard of work, and the day might well come when the dreams dreamed by old men would not be so different from the visions seen by the young.

The general practitioners agree that the amount of their work has been increased; apparently urban practice has been more changed than practice in the rural districts in this regard, perhaps because of the inherent conservatism of country folk. The two young doctors view the Service with measured doubt.

Perhaps no feature of the Service has led to more public controversy than the General Dental Service. In the dentist's view:

. . . the General Dental Service has unquestionably provided necessary dental treatment for millions of the adult population who probably would not otherwise have received it, with a consequent improvement in their general health. It has also brought a considerable measure of financial prosperity to a large number of the dental profession.

This dentist, however, goes on to point out two real dangers: it is much easier for dentists to obtain approval for extractions and for the supply of dentures than for long and often expensive conservative treatment. Herein lies one danger—the temptation for the dentist to take the line of the least resistance and to estimate only for the kind of treatment which he has found by experience, is easily and quickly approved by the Dental Estimates Board. The second danger is the effect of the new Service on the School Dental Service. Although this, and the maternity and child welfare dental services, were given priority by the Act, the attraction of much higher remuneration has resulted in the drift of dentists from the School Dental Service to private practice within the General Dental Service. The dental profession is therefore apprehensive that serious harm may be done to the important child and maternal dental services if this situation is allowed to continue. It is pointed out elsewhere, though not by the dentist, that payment by items of service may turn out to be extravagantly expensive and that payment by capitation fee is a fairer and more economical method. The remuneration to dentists is still under consideration and may be subject to further changes.

From the sociological point of view, the article on the cost of the Health Service is perhaps still the most controversial. The original estimate of its net cost to the taxpayer was £126 millions; this estimate was made in 1946 and was based largely on the cost of the old National Health Insurance Scheme. The final estimate for 1948-49 has swollen to £278 millions; a part of the increase is of course due to the rise in all costs during the past three years, but the major reason for the error in estimates has been the unexpected and unprecedented demand for medical services, especially pharmaceutical, dental and ophthalmic. Of the weekly contributions, which vary from a total of 9s. 1d. (4s. 2d. from employer and

4s. 11d. from employee) for male workers to 6s. 2d. for self-employed persons and 4s. 8d. from non-employed persons, an average of 6d. to 10d. is allocated towards the cost of the National Health Service. The balance of the contributions is in favour of unemployment insurance, sickness benefits and old age pensions. Contributions are payable by everyone between the school-leaving age and the pensionable age, with certain exceptions—notably housewives, who may elect either to contribute, thus receiving full pension benefits, or to enter the Scheme as dependants of their husbands. The health services provided are free of charge, except where any provision of the National Health Service Act expressly provides for the making and recovery of charges, and is available to all.

Let the economist speak on this vexed question of costs:

A country can only have the standard of living it can pay for; and the standard of living includes the National Health Service as one of its components, but only one, and not one with an overriding priority. It is often argued that a Health Service will increase the national income because it will bring better health to the workers with a consequent increase in their productivity. But the argument is just the same for all the social services. Workers will produce more if they are better educated, if they have more security, more comfortable houses, cheaper food, and the prospect of an adequate pension on retirement. Some of this may be true—in the very long run. In the short run, there is no escaping the fact that the social services have to be paid for out of taxation—in one form or another—and this taxation is placing a burden on the country at the very time when it can least support it, at a time when its main hope for weathering the present economic crisis is through a reduction of costs over its whole structure. When costs have to come down, the cost of Government cannot be allowed to rise indefinitely—not even on such an important item as the National Health Service.

Since this survey of the Service was written, it has been proposed to make a charge of not more than one shilling on prescriptions. It is generally felt that when the first rush is over the Service will settle down and some of the undoubted abuses will be eliminated.

The experience of Britain in this field will be carefully watched abroad, and will probably have important effects on the development of medical practice in other countries. For this reason, among others, *The Practitioner* has performed a very real service in bringing out this survey. No other such compact source of information is at present available.

D. F.

1429

## BRITISH COMMONWEALTH COLLECTIONS OF MICRO-ORGANISMS

At the British Commonwealth Scientific Official Conference in 1946 it was recommended that a directory of the important culture collections of the Commonwealth should be prepared. As a result the *Directory of collections of micro-organisms maintained in the United Kingdom and Crown Colonies* (His Majesty's Stationery Office, price 6d.) has been published. It gives a comprehensive list of the various institutions maintaining such collections in the United Kingdom and the Crown Colonies, together with a brief description of the various collections and the relevant information concerning the terms of distribution of specimens to research workers. The directory does not include the collections in the various Dominions, and is to that extent incomplete. However, it should provide much useful information for workers engaged in all types of bacteriological and protozoological research. Further information may be obtained from the Secretary, United Kingdom National Committee of the British Commonwealth Collections of Micro-organisms, 38 Old Queen Street, London, S.W.1.

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## A GERMAN-ENGLISH MEDICAL DICTIONARY

The late Dr. F. S. Schoenewald, when he was obliged to leave Germany, used his leisure to compile a German-English medical dictionary which would be more than a mere glossary, and would give as much help as possible in selecting the most suitable word. The words included are those found in some 30,000 pages of Anglo-American medical literature, which were translated into German to form the English-German section and then back into English to form the German-English section which is here reviewed.<sup>1</sup> It differs from most technical dictionaries in that it includes many words that are not purely technical terms and the use of most of the English translations is illustrated by one or more phrases. The different uses of the German words are not illustrated, and this

<sup>1</sup> For particulars, see p. 274.

makes the dictionary more useful to the German-speaking than to the English-speaking translator. The illustrations are not always very illuminating, and sometimes there are too many for one word and none for another. To take a word at random, *Farbe* is given as "colour—(am. color) the mucous membranes were of a good c.—the skin acquires a bright red c.—a dusky c. appears—c. blind c. blindness—the urine will be red in c.—; dye—the known strength of a d.—the d. excretion may fall low—the area was occasionally dabbled with the d. mixture—; hue—ashen-grey h. as sign of shock—leaden-grey h.— the skin assumes a dusky h.—; paint—lead p. was being applied by means of a spray—; stain—; tinge—of a slightly greenish t.—buff t.—; tint—lemon-yellow t.— to give a dark t. to the blood—buff t.—" The book is easy to handle and clearly printed, but some distinction in type might usefully have been made between the English word and its illustrations. Although details can be criticized in this, as in any other dictionary, Dr. Schoenewald has provided the translator of German medical literature with a tool of a new and useful kind, a dictionary in itself, sufficient for anyone reasonably familiar with German, and not merely a technical supplement to a general dictionary.

M. A. V.

1431

## NEW JOURNALS

Since the Second World War the number of medical journals has multiplied, and it requires courage of a high order to add to the increasing throng. Yet, where knowledge advances and techniques multiply, it is inevitable that the devotees of these new methods will want new channels of communication so that the proper development of their subject will be assisted if not assured.

*Electroencephalography and Clinical Neurophysiology*, the official organ of the International Federation of EEG Societies, is a new international journal which will fill an urgent need; that it is not hastily conceived is evidenced by the fact that plans for it were first drawn up in June 1947 by the Executive Committee of the International EEG Organization at their first meeting in London. The ramifications of neurophysiology in general and electroencephalography in particular are many, but as a special branch of medicine its distinguishing feature is perhaps the broad scientific basis on which it rests; it is clearly in the interest of all concerned that an authoritative journal, preferably of international scope, should be devoted to it, and such is the present journal. The annual volume will consist of approximately 500 pages, and will appear in quarterly issues; the subscription is \$8.00 (American or Canadian). The sponsors can be satisfied that in Herbert H. Jasper and W. Grey Walter they have found an able editor and co-editor who will be energetic and efficient. No. 1 of vol. 1 (February 1949) contains a symposium on the "Physiological Basis of Epileptic Discharge"; regular features, which follow the main articles, are Communications, Technical Notes, Proceedings of the EEG Society, and a very useful Index to Literature. The numerous figures and half-tone illustrations are of a high standard and the editors are to be congratulated on the production of a very fine journal.

*The Journal of the Faculty of Radiologists* (Bristol), a new quarterly of which the first issue appeared in July 1949, will henceforth serve as the official organ of the Faculty. It is edited by Dr. Peter Kerley and will be devoted to the publication of original articles dealing with both radiotherapy and radiodiagnosis. As one would expect, the editorial board includes many of the leading exponents of the specialty, and the fact that it is published by John Wright & Sons of Bristol will ensure that a high standard of production is maintained. The annual subscription is £2 2s.

The appearance in July 1949 of the first number of *Annals of the Institute of Laryngology & Otology* (London) means that henceforth the clinical experience gained in the Royal National Throat, Nose and Ear Hospital, the largest hospital in Great Britain devoted solely to this specialty, will be preserved in a more permanent form. Contributors will apparently be restricted to past and present members of the Institute, and the new publication will thus be analogous to the various Hospital Reports published by so many institutions; no doubt it will prove of equal value to the best of these. Frequency of publication and subscription rates are not given, but vol. 1, no. 1, which we have seen, is impeccably produced and of a high standard.

It is generally agreed that accurate, complete and up-to-date records are essential in the modern practice of medicine and a *sine qua non* of clinical research. The Association of Medical Records Officers has instituted a new journal, *The Medical Record* (Pontefract); it is hoped that this journal will help to disseminate news and views of development in record-keeping technique. This journal, of which we have received the number for May 1949, is to be a quarterly and will be issued free to members of the Association; to others, the price is 1s. per copy.

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From Holland it has been announced that the Dutch College for the Advancement of Surgical Science has undertaken the publication of a new journal—*The Dutch Archives of Surgery* (*Archivum Chirurgicum Neerlandicum*) (Arnhem). The constituent bodies of this College include the Dutch Societies for General Surgery, Orthopaedic Surgery, Urology, Neuro-surgery, Plastic Surgery, Thoracic Surgery, and Anaesthesiology; the new journal will serve as the official organ of these societies, and will be entirely devoted to the interests of surgery. For the most part articles will be printed in English, though manuscripts may be submitted in Dutch, German, French or English; it is the avowed policy of the editorial board to encourage contributions from workers in other countries of Western Europe. One interesting plan is the attempt which will be made to co-ordinate the treatment of varying aspects of the same disease by exponents of the different specialties; for instance, in 1948 the members of the College, including orthopaedists, urologists, and neuro- and thoracic surgeons as well as general surgeons, attended a Congress devoted to the study of tuberculosis from their various standpoints. The journal will be published quarterly. The subscription rate in the British Empire is £2 2s. annually, and the English agents are Messrs. Baillière, Tindall & Cox, London.

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From Argentina we learn that the Facultad de Higiene y Medicina Preventiva de la Universidad Nacional del Litoral, Santa Fe, has begun a new publication devoted to public health and preventive medicine. Vol. 1, no. 1 (March 1949) of *Anales de Medicina Pública* consists largely of articles written by members of the Faculty. It is well produced and each article has an English summary, which, unfortunately however, contains many typographical and other errors. The frequency of publication is not specified.

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In 1946 the medical officers of the municipal health services of São Paulo founded what has proved to be a very active professional society: the Sociedade Médica da Municipalidade de São Paulo. This medical society has now undertaken the publication of a quarterly journal, *Arquivos Médicos Municipais*; its chief function will be to preserve the papers delivered before the society in a more permanent form. If the high standards of the first two issues, dated March and June 1949, are preserved, its success will be assured.

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*Archivos del Hospital Universitario*. In Havana, a new series of hospital archives has been inaugurated. The new publication is sponsored by the Asociación de Internos del Hospital Universitario "General Calixto García"; it will be published bimonthly and the subscription rate is \$5.00 annually.

1432

## JOURNALS NEWLY RECEIVED

The papers presented at the second South American congress of neurosurgery, held in Santiago de Chile in April 1947, have since been published as vol. 4, 1948, of *Neurocirugía* (Santiago), organ of the Instituto Central de Neurocirugía y Neuropatología de Chile. The official subjects chosen for this congress were hydrocephalus, histology of tumours of the central nervous system in relation to their clinical aspects, and cerebral abscess. Twenty-two papers on these subjects, and four on others freely selected, are included. March 1949 was chosen as the date of the next congress, which was held in Buenos Aires.

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*Bollettino della Accademia Medica Pistoiese "Filippo Pacini"* (Pistoia), vol. 19, December 1948, contains the text of papers presented at meetings of the academy during the year, with reports of the discussions, and an account of the post-war restoration and

opening of the academy's new premises in the Ospedale del Ceppo, Pistoia. The 16 papers deal with varied subjects in clinical medicine and surgery. Besides the usual illustrations, views of the hospital and of other interesting buildings in Pistoia are included.

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The *Bulletin of the Institute of Marine and Tropical Medicine, Medical Academy in Gdansk, Poland*, of which we have received vol. 2, no. 1-2, 1949, is intended to provide information on the scientific work of the Institute and articles dealing with the problems of the Polish Marine Health Services. The journal is published in English, and the present number includes 16 articles, most of which are summaries of research work carried out in the laboratories of the Medical Academy in Gdansk.

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In the last number of this Bulletin, *A Crimça Portuguesa* (Lisbon) was the subject of a note which referred to the international outlook of this journal. This aspect is now further developed in vol. 8, 1948-1949, which is to be the first of a series of numbers devoted to paediatrics in other countries, beginning with Belgium. Written almost entirely in French, this number includes articles on the institutional care and education of mentally and physically defective or anomalous children, probation officers' work with children, school medical services, child guidance, and the training of clinical psychologists. If other countries are dealt with in the same comprehensive way, this series should provide a valuable source of information on modern paediatric practice.

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An editorial body made up largely of members of the faculty of medicine of Seville University is responsible for the production of *Acta Clinica* (Seville). We have received the number dated April-May-June 1949, which contains six original articles, dealing respectively with diazo reaction of biliary pigments, open-circuit endotracheal intubation anaesthesia with positive pressure apparatus, superficial punctate keratoconjunctivitis, persistent ductus arteriosus, and treatment of recurrent fever with penicillin. Book reviews, abstracts, and a report of the national congress on allergy are also included. Clear printing gives this journal an attractive appearance. It is a pity that the numbering of the volume and part has been left a matter of deduction; from this kind of omission spring those minor bibliographical mysteries whose unravelling can be either a pleasure or a plague, according to the amount of time at one's disposal.

*Archivos del Instituto de Medicina Práctica* (Barcelona) has completed 24 years of publication with the number which we have just received (second series, vol. 1, no. 1, July 1949). This number contains four original articles, on sensation in tonsillectomy (Drs. J. Ferré & J. Prades Pla), psychosexual physiology (Dr. N. Bonnin Segura), T. Levine's medium for *B. coli* cultures (Drs. A. Valls Conforto & L. Borrás Lafuente), and nerve lesions with neuritic irritation (Dr. J. Martí Abizanda).

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From time to time this Bulletin has published reviews of volumes in the *Colección Española de Monografías Médicas*, published by Ediciones B.Y.P. of Barcelona under the direction of Dr. J. Puig Sereda. This series has proved its popularity by growing in a few years to about 63 titles, some of which have been given a double number. The last volume we have received (1949, no. 95-97: *Leptospirosis: linderos actuales y posibilidades diagnósticas*, by Dr. A. Abellán Ayala) contains an announcement of another 13 monographs in preparation.

The orientation of the series is essentially clinical and practical, with emphasis on therapy, and the subjects chosen are usually of dimensions suitable for treatment in an essay of some 100 pages. A few wider subjects have also been attempted; there is, for instance, a two-volume manual of dietetics, and a three-volume manual of infectious diseases. Such homely themes as first aid, whooping cough, and the painful shoulder have not been despised; towards the other end of the scale there are volumes on plasma proteins, intracranial tumours and indications for thoracoplasty. The series is well produced in an attractive format.

The editors have not confined themselves entirely to Spanish contributors. There are translations from German, Roumanian, and English; the latter group comprises Dr. T. H. Howell's *Old age*, Dr. P. F. M. Bishop's *Gynaecological endocrinology*, and an American contribution, Dr. Milton B. Cohen's *Manual of allergy*. Bibliographies are usually included; some of these are prepared with obvious care, while others show a good many inconsistencies. Besides the main essay, each volume contains a section of "Practical notes on diagnosis and treatment", consisting of short original articles and translations from foreign journals.

These volumes are handy in size, well printed, and illustrated where appropriate with line-drawings, charts, and photographs in monochrome and colour; many of the latter appear as plates, instead of in the text, with advantage to their quality. The publishers are to be congratulated on initiating this useful and attractive series for the benefit of Spanish practitioners.

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The following journals have also been received:

- Anales Neuropsiquiátricos del Frenocamio de Mujeres* (Bogota), vol. 3, no. 11, 1949
- Archivos Argentinos de Kinesiología* (*Kinesiterapia y Kinefilaxia*) (Buenos Aires), vol. 2, no. 3, 1949
- Baletin de Infarmaciones Parasitarias Chilenas* (Santiago), vol. 4, no. 1, 1949
- Iparegészsegügy.* (*Hygiène du Travail*) (Budapest), vol. 2, no. 4, 1949
- Journal of the Faculty of Medicine, Baghdad, Iraq* (Baghdad), vol. 13, no. 1, 1949
- Medicina y Ciencias Afines* (Bogota), vol. 1, no. 1, 1949
- Medicina Práctica* (Saragossa), year 7, no. 62, 1949
- Revista del Instituto Médico "Sucre"* (Sucre, Bolivia), year 46, no. 86, 1949
- La Tunisie Médicale* (Tunis), year 37, no. 3, 1949



# Historical Notes

1433

## A NOTE ON BRITAIN'S CONTRIBUTION TO MENTAL NURSING

Early in the last century a system obtained in France whereby persons to be employed as attendants of the insane had opportunities to learn something of the work, by observation as assistants, before they were put in charge of patients; instruction of some kind was also given to attendants at New York Hospital in 1798. It was, however, in Britain that the first modern course of lectures was given to mental nurses, and that the first national system of examination for them was established.

As early as 1830 Dr. John Conolly advocated that every asylum should be "a school of instruction for male and female attendants."<sup>1</sup> Seven years later Dr. W. A. F. Browne, in a lecture delivered at Montrose Royal Lunatic Asylum in Scotland, also referred to the need for preparing "keepers" for their work and for raising their status. Dr. Browne later transferred to the Crichton Royal Institution, Dumfries, and there, from October 1854 to May 1855, he gave a course of 30 lectures to the medical and nursing staff.<sup>2</sup> It is believed that these were the first systematic lectures given to mental nurses in any country. The instruction embraced "a full, if somewhat popular, discussion of insanity in the different forms, intelligible by the shrewd and sensible, if somewhat illiterate class of persons, employed as attendants and nurses." About the same time there were other stirrings. Mrs. A. B. Jameson in her book, *Sisters of charity* (London, 1855), pointed out the need for a good feminine influence for insane men as well as for insane women, and the Commissioners in Lunacy, in their 9th report (London, 1855), recommended the appointment of head attendants of a superior type and referred to the experiment of placing a well-educated lady as "a companion to female patients of the upper classes".

It cannot, however, be claimed that much came of all this, for when Dr. Browne's son, Sir James Crichton Browne, had charge of the Crichton Royal in 1865, nurses were still there who had to get their mental patients to read the directions on the medicine bottles for them.<sup>3</sup> In 1876 Dr. T. S. Clouston read a paper to the Medico-Psychological Association, in which he recapitulated the points about the need for proper pay and status for asylum attendants, put forward by Dr. Conolly nearly 40 years previously and frequently referred to in the reports of the Commissioners in Lunacy. In addition he asked whether medical officers should not "spend a special time each day" in instructing attendants.<sup>4</sup>

Dr. Samuel Hitch, a founder of the Royal Medico-Psychological Association, had as early as 1841 been a pioneer in employing some women in the nursing of male patients at Gloucester Asylum. Following Dr. Clouston's address, the Association took a special interest in the training of nurses. In 1885 a subcommittee of Scottish alienists brought out the first edition of the Association's *Handbook for the instruction of attendants on the insane* (London, 1885). The object of the book was to enable mental attendants "to do their work with greater intelligence and usefulness". A review of it in the *Journal of Mental Science*<sup>5</sup> appeared on the same page as an obituary notice of Dr. W. A. F. Browne. The reviewer questioned the advisability of teaching attendants about such things as white and grey matter, but the handbook became very popular, and in 1888, for instance, was being used as the basis for lectures to nurses at Dordrecht Asylum in Holland. The book has been through many editions, the eighth, under the present title of *Handbook for mental nurses*,<sup>6</sup> being now in preparation. In 1889 another committee was set up, and as a result of its recommendations the Medico-Psychological Association started its examinations for mental nurses, the first of which was held in 1891. The examinations were the first, and remained for many years the only, uniform national system of training and certification for any body of nurses in any country. When the General Nursing Councils in England, Scotland and Ireland were set up in 1922, they arranged to conduct examinations for mental as well as for general nurses, the first final examination being conducted for England and Wales in 1925. The examinations for mental nurses, of both the General Nursing

Council and Royal Medico-Psychological Association, continued until recently when, in 1947, the General Nursing Council, by agreement, became the sole examining body.

Laurence Dopson

### REFERENCES

- <sup>1</sup> Conolly, J. (1830) *An inquiry concerning the indications of insanity, with suggestions for the better protection and care of the insane*, p. 481, London
- <sup>2</sup> Easterbrook, C. E. (1940) *The chronicle of Crichton Royal*, p. 640, Dumfries
- <sup>3</sup> Tooley, S. A. (1906) *History of nursing in the British Empire*, p. 247, London
- <sup>4</sup> Clouston, T. S. (1876) *J. ment. Sci.* 22, 381
- <sup>5</sup> *Journal of Mental Science* (1885) 30, 149
- <sup>6</sup> Royal Medico-Psychological Association (1923) *Handbook for mental nurses*, 7th ed., London

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## JAMES COWLES PRICHARD AND "MORAL INSANITY"

James Cowles Prichard, the centenary of whose death fell at the end of last year, was a British alienist who originated the theory of "moral insanity" and was also a distinguished anthropologist. In addition to being a Fellow of the Royal Society, he was a corresponding member of the Institute of France, the French Academy of Medicine, the American Philosophical Society and the Academy of National Sciences of Philadelphia; he was an honorary Fellow of King's and Queen's College of Physicians in Ireland, and many of his books were translated into German and French.

Prichard was born at Ross in Herefordshire on 11 February 1786, of Quaker parents, and was educated at home. The studies to which he "most eagerly addicted himself" were history and languages—he learnt to speak French, Italian, Spanish and modern Greek. He turned to medicine as a career "not from any bias towards it but because it presented no difficulties to him as a member of the Society of Friends, and at the same time permitted of his pursuing his favourite studies."<sup>1</sup> In 1802 he became a student of medicine at Bristol, where he was then living with his parents. He afterwards moved to the medical school attached to St. Thomas's Hospital, London, and then put in three "hard years" of study at Edinburgh. Here, in addition to the medical lectures, he also attended the lectures of Douglas Stewart and Playfair on metaphysics and natural philosophy—the medical curriculum was less crowded in those days.

Early friends of the young Prichard have spoken of his great love of fun. At Edinburgh, however, he was already manifesting his interest in anthropology and in the varieties of the human race. A fellow student wrote: "A shade of complexion, a singularity of physiognomy, a peculiarity of form, would always introduce the one absorbing subject." After graduating M.D. from Edinburgh in 1808, Prichard resided for a year at Trinity College, Cambridge, and then returned as a doctor to Bristol. Here, in addition to his private practice, he attended and treated the poor, without fee. In August 1811 he was appointed physician to St. Peter's Hospital, Bristol—a most important event in his life since it was the beginning of his interest in mental illness.

On cases at St. Peter's, Prichard published in 1822 his first book devoted to mental illness (*A treatise on diseases of the nervous system*, London); it was marked "Part the First", but no subsequent parts were published. In this book Prichard took a view quite different from that which he was subsequently to adopt; thus in it he discountenanced the suggestion that an accident to a boy, in a case reported from Copenhagen, could have been the cause of the sudden development of a depraved moral character. "If stories of this kind gain credit, the College of Surgeons may expect one day to march in triumph and take possession of the vacant seats of the judges; and we shall proceed to apply the trepan where now the halter and gibbet are thought most applicable," wrote Prichard, using the sort of argument still heard even today.

Ten years later, however, when he was asked to contribute to the *Cyclopaedia of practical medicine*, he put forward for the first time the term "moral insanity", which he defined thus:

Moral Insanity, or madness consisting in a morbid perversion of the natural feelings, affections, inclinations, temper, habits, and moral dispositions, without any notable lesion of the intellect or knowing or reasoning faculties, and particularly without any maniacal hallucinations.<sup>2</sup>

He elaborated his views in a volume published in London in 1835, *A treatise on insanity, and other disorders of the mind*, which became a standard work for many years. In this, he noted that

these patients "often display great ingenuity in giving reasons for the eccentricities of their conduct, and in accounting for and justifying the moral feeling under which they appear to exist", and that the prognosis "is often more unfavourable than in other forms of mental derangement." Prichard makes it clear that this work would never have been written had he not been stimulated by the request to contribute to the *Cyclopaedia*, so it is to the editors of this, perhaps, that we are indirectly indebted for the proposition of moral insanity. In an article in *A system of practical medicine*, Prichard, who was a modest man, states definitely that he first introduced this theory.<sup>3</sup> In addition to papers on insanity, Prichard wrote for both the *Cyclopaedia* and the *System* on delirium, hypochondriasis, somnambulism, animal magnetism, soundness and unsoundness of mind, and temperament.

Prichard's book of 1835 is dedicated to Esquirol. Esquirol did not at first accept the proposition of moral insanity, but in 1838 admitted: "I have been obliged to submit to the authority of facts."<sup>4</sup>

In 1842 Prichard published a book entitled *On the different forms of insanity, in relation to jurisprudence, designed for the use of persons concerned in legal questions regarding unsoundness of mind* (London). It appeared at an appropriate time, for in this year a certain McNaghten was acquitted of murder, on the grounds of insanity, after he had shot the Prime Minister's secretary in mistake for the Minister; Prichard's book was quoted by counsel at the trial. It was as a result of McNaghten's acquittal that the House of Lords put a series of questions to the judges, whose majority replies (there was one dissentient) form the McNaghten Rules<sup>5</sup> which still govern the matter of insanity in relation to criminal acts in this country.

In 1835, on the occasion of the installation of the Duke of Wellington as Chancellor, the University of Oxford conferred on Prichard the degree of M.D. by diploma. Prichard was one of the Metropolitan Commissioners in Lunacy and when Dr. H. H. Southey, one of the new Commissioners in Lunacy created under the Act of 1845, resigned soon after his appointment, Prichard was appointed in his stead. He then left Bristol and moved to London. Whilst visiting Salisbury in his official capacity three years later he was taken ill and was brought back to London. "The disease baffled all the efforts of his medical friends, and, after great suffering, he died on the 23rd of December, 1848."<sup>1</sup> The *Lancet*, in an obituary notice,<sup>6</sup> states that in addition to rheumatic fever there was pericarditis (which, that journal then thought necessary to explain to its medical readers, was "inflammation of the membrane containing the heart")<sup>7</sup> and extensive suppuration in the knee-joint." The *Lancet's* epitaph of Prichard was that "he furnished, indeed, a bright example of the scholar, the gentleman, and the Christian." Tuke, after quoting an account of Prichard's modesty by Professor Gibson of Philadelphia, says the following lines are "eminently descriptive" of the man:

In manners gentle, of affections mild,  
In wit a man, simplicity a child.<sup>7</sup>

Symonds<sup>1</sup> gives this description of his person:

Dr. Prichard was in stature rather below the middle height, and of rather slight make. He had light hair, and grey eyes, which, though somewhat small, were of singularly intelligent expression. The form of his head was very fine, broad and prominent in the forehead, lofty and capacious in the crown. . . His voice was rather weak and low, but very distinct in articulation. His manners and deportment . . . were simple and unaffected.

In this note a brief reference only has been made to Prichard's contribution to psychiatry. Perhaps even more to his own heart was his work on anthropology. His earliest publication was *Researches into the physical history of man* (London, 1813). In 1819 he wrote *An analysis of the Egyptian mythology: to which is subjoined a critical examination of the remains of Egyptian chronology* (London). The first edition of his great work, *The natural history of man: comprising inquiries into the modifying influence of physical and moral agencies of the different tribes of the human family*, appeared in London, 1824. Another work was *The Eastern origin of the Celtic notions proved by a comparison of their dialects with the Sanskrit, Greek, Latin and Teutonic languages* (Oxford, 1831). A further facet of Prichard's interest is revealed by his *History of the epidemic fever which prevailed in Bristol, during the years 1817, 1818, 1819; founded on reports of St. Peter's Hospital and the Bristol Infirmary* (London, 1820). In 1829 there appeared *A review of the doctrine of a vital principle, as maintained by some writers on physiology* (London).

As to Prichard's contribution to psychiatry, his concepts led the

way to further progress. Tuke has summed it up in these words: "Though he did not live to see it, Prichard has had his triumph."

Laurence Dopson

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#### 1435

#### SIR GILBERT BLANE 1749-1834

The bi-centenary of the birth of one of the most illustrious medical men associated with the British Navy fell on 29 August 1949. Sir Gilbert Blane, who was chiefly instrumental in banishing scurvy from the Royal Navy, was born at Blanehead, Ayrshire. He entered Edinburgh University with a view to an ecclesiastical career, but changed his mind. William Cullen, who persuaded William Hunter, the famous obstetrician, to take up medicine instead of the church, was then Professor of Medicine at Edinburgh and one can speculate that he may have influenced Blane's decision too. Blane spent five years studying medicine at Edinburgh, and was president of the students' Medical Society there in 1775, but he qualified M.D. on 28 August 1778 at Glasgow, not Edinburgh. Here again one may like to trace the influence of Cullen, who also graduated at Glasgow.

It was Cullen who introduced Blane to William Hunter, who in turn recommended him to Lord Holderness, whose private physician Blane became (Payne, 1886). After a while the influence of Hunter and Holderness led to Blane's sailing as private physician to Sir George Rodney, who had been appointed Admiral of the Fleet in the year Blane qualified. In 1779 Rodney put to sea for the relief of Gibraltar and appointed Blane Physician to the Fleet. The new Physician, observing that more care was taken of the stores than of the sailors, immediately proceeded to "enlighten the commanding officers, as far as lay in my power, regarding the most effectual means of maintaining the health and vigour of the men" (Blane, 1822).

When Sir George Rodney returned to England in the autumn of 1781 Blane accompanied him and took the opportunity, on 13 October, of presenting a memorandum to the Board of Admiralty, setting out the medical needs of the Navy. On 3 December of that year Blane was also admitted a Licentiate of the Royal College of Physicians, a necessary step for anyone who wished to practise in London at that time. It was about this time that Sir George Rodney had audience with King George III, who expressed anxiety regarding the safety of the West Indies, then threatened by the French. With commendable dash Rodney promised the King that he would sail forthwith without waiting for reinforcements, and, accompanied by his secretary and Blane, he repaired to Portsmouth. The party sailed with the only four ships available, but weather delayed them, and eventually Rodney found himself at the head of the largest British naval force ever assembled up to that time on a foreign station. The French were decisively beaten in the Battle of the Saintes, 12 April 1782.

Blane was with Rodney on the quarter-deck of the *Formidable* throughout the action, and emerged as an early exponent of first aid (Blane, 1822).

It occurred to me . . . that I might possibly be of some use in this spot in case of any severe injury threatening life from hæmorrhage, and for this purpose I carried some tourniquets about me of a simple construction . . . Would it not be advisable at all times that some intelligent person, a warrant or petty officer, quartered on the quarter-deck, should carry in his pocket some such instrument? . . . He need not be a medical officer; and the only instruction necessary would be to point out to him the situation of the great artery in the thigh and arm; or with this information alone, the blood might be stopped by a handkerchief tied tight.

Peace came in 1783. Rodney was rewarded with a peerage and £2,000 per annum. Blane, who had been present at six general engagements during his period of service, was not forgotten (Munk, 1878):

Although the mode of his appointment precluded him from enjoying half-pay, yet, in consequence of the unanimous application to the Admiralty of all the principal officers who had been on the station, he was rewarded by a pension from the Crown, which pension at a later period was doubled by recommendation of the Lords of the Admiralty. . .

Rodney's influence and prestige was at its height, and in support of Blane his lordship wrote to the Governors of St. Thomas's Hospital (Payne, 1886).

To his [Dr. Blane's] knowledge and attention it was owing that the English fleet notwithstanding their excessive fatigue and constant service, were in a condition always to attack. . . In my own ship, the *Formidable*, out of 900 men not one was buried in six months.

As a result of Lord Rodney's recommendations and those of Sir Walter Farquhar, a former Army physician who had served at Gibraltar, and of Dr. R. Huck Saunders, Physician to St. Thomas's Hospital, 1768-1777, Blane was elected Physician to St. Thomas's on 19 September 1783 (Parsons, 1934).

The year 1785 was a fortunate one for Blane. On 13 January he was admitted a Fellow of the Royal Society (he delivered the Croonian Lecture on Muscular Motion, 13 and 20 November 1788), and through the Duke of Clarence's recommendation became Physician Extraordinary to the Prince of Wales, an appointment that was to lead to that of Physician in Ordinary to King George IV and later to King William IV. In 1785 too he published his *Observations on the diseases incident to seamen* (London), his best known work. On 18 November 1795 Blane resigned his post at St. Thomas's. It was in this year that he was appointed to a commission to improve the sanitary conditions in the Navy.

At last Blane was able to carry through his reforms. He had recognized that it was the want of lemon or lime juice that was causing scurvy in H.M. ships, and when, as the result of his efforts, the universal use of lemon juice was ordered the scurvy disappeared. Blane had also complained of the lack of soap and medical supplies, but he was not to see free soap for sailors and free issues of medicines to naval surgeons until 1804 (Comrie, 1932). From 1795 onwards the British Government continued to seek the advice of Blane, but perhaps the most noteworthy occasion was when he was charged with investigating the mortality among the troops on the island of Walcheren. The expedition was abandoned as the result of his report. Blane's many services were rewarded by a baronetcy conferred by the Prince Regent, 26 December 1812.

In 1821 Sir Gilbert Blane's health began to fail. He was attacked with prurigo senilis in its most inveterate form. For this he took opium in gradually increasing doses, but was actively writing almost until his death on 27 June 1834, in the eighty-seventh year of his age.

He was a brave and warm-hearted man, if rather austere. It is said that he was nicknamed "Chilblane" because of a certain coldness of manner, but he spared no pains in improving the conditions for the men under his care. He maintained his interest in the Royal Navy all his life, and in 1829, five years before his death, he founded a medal, which is still awarded, for the best journal kept by a naval surgeon. His most lasting claim to remembrance will be his untiring efforts to banish scurvy from the Navy by the universal use of lemon juice, which, though it was suggested by James Lind and others, owed its final introduction to Sir Gilbert Blane.

F. A. Tubbs

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1436

## VESALIUS : ANATOMIST (1514-1564)

### *Tabulae Anatomicae Sex*

Vesalius lived at a time when medical thought was undergoing a change from medieval mysticism to a more rational study of man. In the conflict of confusing ideas, in which many participated, Vesalius stands out as dominant; according to the two distinguished authors of *A prelude to modern science*\* (Charles Singer,

the well-known professor of the history of medicine, and C. Rabin, a noted Oriental scholar), his work "heralds the modern spirit of research".

His *Tabulae Anatomicae Sex* are reproduced in their book, in plates one-quarter of the actual size. The originals, apparently meant to hang on the wall for students to see, appeared in 1538, and only two sets are now extant, one in the Hunterian Library of Glasgow University and the other in St. Mark's, Venice. This modern publication does great credit to the authors, and to its publishers, the Wellcome Historical Medical Museum; and it opens our eyes to the tremendous difficulties under which our forefathers laboured, of which the confusion of nomenclature was only one. The book consists of three parts, of which the six extending plates form the third. The text falls into two parts: a historical and critical discussion of Vesalius and of the appearance and significance of the *Tabulae*, and a translation and running commentary of the printed matter on the plates, the commentary being largely concerned with the passage of anatomical terms from medieval to modern forms.

"The influence of renaissance art," remark the authors, "did not penetrate medical literature until late and then but slowly. Vesalius was himself the first effective pioneer of the application of art to anatomy." The *Tabulae*, however, are not all of the same genre, they are not beautiful and none has the charm of Leonardo's drawings. Singer & Rabin believe that the first three "were certainly drawn by Vesalius"; they are "mere 'physiological diagrams'", but are significant as being "the first pictorial exposition of the Galenic physiological system." Vesalius was brought up on Galen, but he changed, and this book discusses the question of how he changed.

The first plate, showing the liver, the portal venous system, and the male and female generative organs, is not impressive. A better picture of the portal system, from the *Fabrica*,<sup>1</sup> has been reproduced, much diminished in size, in the present volume (fig. 51). Looking at this, one wonders how the blood entering the radicles of the portal vein can ascend, reach the liver, traverse it and enter the vena cava—without the abdominal wall muscles, it could not happen! The drawing of the uterus, with its two great processes sticking out, one on each side, may interest the gynaecological student.

The second plate shows the liver, the vena cava and the whole venous system except the portal and pulmonary. Galen believed the liver to be the source of the blood and of the veins, and that the tissues were nourished by blood ebbing and flowing in the veins.<sup>2</sup> He got these ideas from Erasistratus (300 B.C.), against whom he constantly tilts. Nowhere in Galen have I found an explanation of the mechanism of this tidal process. Empedocles (ca 450 B.C.) had also thought that the blood ebbs and flows.<sup>3</sup> We know today that a reversal of the blood-stream does occur in tunicates and caterpillars, but that it is caused by the heart. Vesalius, however, follows Galen and heads his *Tabula II* thus: "Description of the vena cava . . . by which blood, nutriment of all parts, is distributed throughout the entire body."

The third plate shows the heart, the kidneys and the general arterial system; that of the lesser circulation is again excluded. There are criticisms of this system, e.g., the rete mirabile, which does not exist in man, is shown; "the aorta and branches here depicted are certainly not human. They are those of an ape . . ."; also, the right kidney is shown higher than the left, as Galen had taught, and Aristotle before him. Vesalius here seems to accept Galen's theory of the transmission of "pneuma" or "vital spirit" through the left ventricle and the arterial system. In his *Blood-letting letter*,<sup>4</sup> published a year after his *Tabulae*, but doubtless being prepared before, Vesalius writes that when the heart dilates, the left ventricle "takes in air", and when it contracts, "it diffuses the [vital] spirit into the aorta. . ." He writes not a word of the blood entering the left ventricle or leaving it. *Tabula III* is headed, "*Arteria magna* . . . arising from the left cavity of the heart; and carrying the vital spirit to the whole body, regulating the natural heat by contraction and dilatation." Thus, the idea that the aorta conveys the blood is in the dark, while its conveyance of "vital spirit" is illuminated. But it was also part of Galen's conception that blood does enter the left ventricle and presumably is discharged when that ventricle contracts; he also knew that an artery spurts blood when cut. Vesalius, too, must have known all this, and, therefore, this heading of *Tabula III* seems a little odd. Why did he not say that the aorta conveys blood instead of "vital spirit"? We may speculate on whether this is a conspiracy of silence, or whether it is human nature shutting its eyes to the most patent

\* For particulars, see p. 274.

truths and opening its arms to embrace the most fantastic of ideas.

The other three plates, representing the human skeleton from the front, from the side and from behind, are by Calcar, a pupil of Titian, and should have been good, but they lack "dignity and movement", and contain "many elementary errors". Singer criticizes them severely: they are nothing like "the noble poses of the *Fabrica* skeletons", the first of which is shown on page xi of the present volume. Saunders & O'Malley impute Calcar as illustrating both the *Tabulae* and the *Fabrica*, under the specific direction of Vesalius. Singer himself, in 1925, referring to the *Fabrica* drawings, said that the "artist's mind that conceived them was surely that of Vesalius himself."<sup>5</sup> It is clear that between the *Tabulae* and the *Fabrica* Vesalius developed, and that he further changed between the first and second editions of the latter.

Before Vesalius, anatomies were undertaken to "confirm and illustrate the entrenched tradition of ancient authority"; with Vesalius they became procedures of discovery.<sup>6</sup> The *Tabulae* present a transitional stage in his mental development, and their significance is that they led to the *Fabrica*. Singer & Rabin ask: "The *Fabrica* of 1543 is essentially a product of modern scientific research though it is set out in the renaissance humanist manner. What induced this change of outlook in the intervening years?" During the period up to the appearance of the *Fabrica* a progressive series of stimuli was playing on Vesalius. As a boy, he dissected all sorts of animals. As a student in Paris he "set his own hand to the business" of dissecting, hitherto a menial duty. Robinson pictures him so exasperated with an anatomy that he pushed the menial making the dissection aside, seized the knife, and proceeded with the affair, to the amazement of Guenther, who was presiding.<sup>7</sup> After that, first at Louvain and then at Padua, he lectured as he dissected, to crowded audiences. Thus did his ideas enlarge and become more defined.

The work of Vesalius is not only of great significance for the furtherance of medicine and science, but also of philosophy. The pre-Socratic philosophers thought that by studying the universe they would come to understand man. But as time passed, this opinion was reversed and we find many pure philosophers, Plato, Servetus, Descartes, Goethe, Nietzsche, studying man. Galen made many errors, but he said one good thing—"Medicine is the best of all professions . . ." If we understand man we shall understand all.

R. H. Paramore

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1437

#### MEDICINE IN THE WESTERN WORLD

Since the unearthing of new data in the well-dug field of medical history is extremely difficult, the modern medical historian can best attain popularity by presenting his subject from a new point of view. The aim of the present work<sup>1</sup> is to discuss the development of modern medicine from the standpoint of its relations with social and intellectual development in general. In other words the book is an international and medical counterpart of Trevelyan's *Social history*, and might almost be regarded as a history of social medicine, using this term in the sense generally understood in England and not the pejorative sense current in the USA. The experiment is an interesting one. The weakness of the book would appear to lie in an attempt to make it attractive to wide audiences ranging from laymen, through social workers, to physicians. As in the case of textbooks written "for students and practitioners" the danger is that the author will end up by pleasing nobody. The layman may find the book heavy going and the medical man may be a little irritated by the author's need to "write down" to the lay level. Thus sentences such as "The most wicked bacteria could and did upon occasion lurk in the most translucent depths" may jar a little. The layman, on the other hand, may be put off somewhat by the formidable list of footnotes. Nevertheless, the book is well worth reading because of the large amount of information condensed into a small compass and should be of particular interest to students of social medicine. The greater part of the book deals with the history of medicine during the last 150 years. The last chapter betrays a divorce from clinical medicine. For example, the author is more optimistic about the value of influenza vaccines than most clinicians would be, and it is surprising to learn that cinchophen is of value in kidney diseases. Misprints and errors are few, but we note that surgeons employ "aseptic" technique and that gramicidin is incorrectly spelt on two occasions.

S. S. B. Gilder

<sup>1</sup> *The development of modern medicine*. For particulars, see p. 274.

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# MEDICINE

1438

## A DUBLIN SCHOOL OF MEDICINE AND SURGERY

J. H. YOUNG M.D. D.Obstet.R.C.O.G.

Across the pages of medical history have moved many notable Irishmen. It is probably true to say that few medical men are today aware of the debt which medicine owes to Ireland. From the pens of such authors as Sir Charles Cameron, Dr. T. P. C. Kirkpatrick, and, more recently, Dr. W. Doolin and Professor O'Donel Browne, the student of medical history can learn much.

Dublin's earliest contribution to medicine was the idea of the voluntary hospital. In 1718, six Dublin surgeons opened a house for the reception of surgical patients of the poorer class. This institution is now the Jervis Street Hospital. The year 1745 saw yet another innovation when Bartholomew Mosse founded the first lying-in hospital for women—the Rotunda Hospital, which celebrated its bi-centenary very recently and the history of which has been so admirably described by Professor O'Donel Browne.

The names of Robert Graves and William Stokes are familiar to all on account of the diseases to which their names have become attached, but perhaps less well known is the fact that to them and their colleague, Robert Carmichael, is due the reformation of medical education. Robert Graves (1797–1853) in his very first lecture in Dublin attacked the current system of medical education, alleging that faulty treatment caused the death of many a patient. At that time hospital lectures were delivered in indifferent Latin, the student noting and memorizing what he could. Graves took his classes to the bedside, allocated a patient to each student, and introduced the system of bedside teaching as we know it today. He was as revolutionary in his methods of treatment as he was in his methods of teaching and it is said that he suggested his own epitaph: "He fed fevers."

His contemporary, William Stokes (1804–1878), the outstanding member of several generations of doctors, ably supported Graves' reforms. Before receiving his degree at Edinburgh University, he wrote a short work entitled *Introduction to the use of the stethoscope*, receiving the sum of £70 for his first efforts at authorship. His *Treatise on the diagnosis and treatment of diseases of the chest*, published in 1837, is a medical classic and was the greatest book on the subject since Laennec's immortal work. Seventeen years later, he published his *Treatise on diseases of the heart and aorta*. He was a foundation member of the General Medical Council. The reputation of Graves and Stokes spread far beyond their native shores and their reforms exerted a profound influence in Europe and America. For over a third of a century, Dublin enjoyed the reputation of being the leading medical school of the world. Robert Carmichael (1776–1848) strongly supported Graves and Stokes in their advocacy of stricter control of medical education. These three men clearly outlined the principles which formed the basis for the Medical Act of 1858.

Another notable figure in Irish medicine was Dominic Corrigan who, at the age of thirty, so perfectly described aortic incompetence and the characteristic pulse which accompanies it that it bears his name to this day. In the study of diseases of the eye and ear, Dublin again showed the way. Simpson's Hospital was founded in 1778 "for elderly men afflicted with gout and blindness." Several other hospitals for diseases of the eye were founded in Dublin during the nineteenth century, the two outstanding surgeons being Arthur Jacob and William Wilde.

Over sixty years have passed since Sir Charles Cameron wrote his monumental work on the history of the Royal College of Surgeons in Ireland and the Irish Schools of Medicine. To the pen of Dr. J. D. H. Widdess, librarian to the College, we are indebted for a new work, *An account of the Schools of Surgery, Royal College of Surgeons, Dublin, 1789–1948*.<sup>1</sup> It is the first separate work on the subject and contains material hitherto unpublished, as well as much that is now gathered together for the first time.

As early as 1703, surgeons made efforts to break away from their age-long union with the barbers, and by 1721 a separate surgeons' society was in being. The first examining body, the County Infirmary Board, examined all candidates for posts in the hospitals under their jurisdiction. Sylvester O'Halloran, a distinguished Limerick surgeon, was responsible for this step. The Dublin Society of Surgeons was founded in 1780 and, on the grant of a Royal Charter in 1784, became the Royal College of Surgeons. Samuel Croker-King was the first president, William Dease and John Halahan the first professors of surgery and anatomy, respectively. Among the first pupils were James Macartney, one of the greatest anatomists Dublin has produced, and Abraham Colles, whose name is familiar to all medical men from the terms Colles' fascia, Colles' fracture and Colles' Law. To Colles, too, we are indebted for the first anatomical work designed on topographical lines. It was entitled *A treatise on surgical anatomy* and was published in 1811. Dease and Halahan were evidently versatile individuals for, in addition to lecturing on surgery, Dease wrote a book on midwifery and Halahan resigned the professorship of anatomy to take up that of midwifery when it was founded in 1789. It is interesting to note that the College refused to subscribe to the current view that midwifery was a degrading occupation. A chair of pharmacology was founded in 1789, to be followed by those of medicine (1813), chemistry (1828), medical jurisprudence (1829), hygiene (1841), pathology (1889) and biology (1889). Professorships in botany, military surgery, logic, ophthalmology and dental surgery also existed for a time but are now abolished.

The founding of a chair of hygiene was a notable event, being the first of its kind in the British Isles. Henry Maunsell was the first holder. He foreshadowed a state-provided medical service, saying in one of his lectures that "the provision of suitable aid in sickness for the public generally, and especially for the poorer classes of it, is another and most important branch of political medicine; and one which, in every well-ordered community, should be recognized as a

<sup>1</sup> For particulars, see p. 274.



main object of Civil Government." Maunsell was succeeded in 1864 by Edward Dillon Mapother who became the first Medical Officer of Health for Dublin. Not until 1871 did the University of Dublin found its Diploma in State Medicine, but it was still the first of its kind in the United Kingdom.

The College flourished practically from the start and in 1804 extensions became necessary. These were completed during the following seven years with the aid of government grants and by 1812 the College was self-supporting. In 1825 the museum was founded, the first curator being John Shekleton who was succeeded by John Houston of rectal "valves" fame. In 1831 the possibility of founding a hospital in association with the College was explored. The City of Dublin Hospital was opened the following year and still flourishes, although the intimate connexion with the College has long since lapsed.

In 1878 the College introduced a licence in dental surgery, the first of its kind in Ireland. In 1889 it amalgamated with the two remaining private medical schools, the Carmichael and Ledwich schools. The combined schools were called "The Schools of Surgery of the Royal College of Surgeons in Ireland, including the Carmichael and Ledwich Schools", and were controlled by the President and Council of the College, as had been the practice hitherto.

For many years the standard of education and examination maintained by the College was the highest in the United Kingdom. It led the way in showing that the study of medicine and the study of surgery must go hand in hand and not be divorced the one from the other as had been the case for centuries. As Carmichael wrote in 1841 :

It is now generally admitted that this distinction between physic and surgery is so artificial and unnatural that it is totally impossible to draw any line of demarcation between them, so as to indicate to either physician or surgeon his particular province; and it is certain that there cannot be a good physician who has not the knowledge of a surgeon, or a good surgeon who has not the knowledge of a physician; therefore, it is obvious that both should be educated alike.

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## 1439 Pulmonary Tuberculosis : Pathology, Diagnosis, Management and Prevention

G. Kayne, W. Pagel & L. O'Shaughnessy. Second edition, revised and partly rewritten by Walter Pagel, F. A. H. Simmonds, N. Macdonald & L. Fatti. London : Geoffrey Cumberlege, Oxford University Press, 1948. xviii + 720 pages ; 268 figures. 25 x 18 cm. £3 3s. [£3.15]

I. Pathology. (i) The tubercle bacillus ; (ii) tissue changes in tuberculosis ; (iii) resistance to tuberculosis ; (iv) the evolution of tuberculosis in man. II. Diagnosis. (v) History taking ; (vi) symptoms ; (vii) physical signs ; (viii) bacteriological investigations ; (ix) radiological examination of the chest ; (x) the tuberculin test ; (xi) examination of the blood ; (xii) forms of pulmonary tuberculosis ; (xiii) pleurisy with effusion ; (xiv) differential diagnosis ; (xv) the complications of pulmonary tuberculosis ; (xvi) conclusions. III. Prognosis. (xvii) Aids to prognosis ; (xviii) the outlook for the patient. IV. The management of pulmonary tuberculosis. (xix) Historical sketch ; (xx) objects of treatment ; (xxi) observation and out-patient management ; (xxii) modes of treatment ; (xxiii) the treatment of some complications and symptoms ; care of the dying patient ; (xxiv) the management of pregnancy and child-bearing in tuberculosis ; (xxv) criteria of progress and completion of treatment. V. Epidemiology and prevention. (xxvi) Epidemiology ; (xxvii) prevention. Appendix A : the classification of pulmonary tuberculosis. Appendix B : streptomycin and other chemotherapeutic agents. Index of persons. Index of subjects.

Since the 1st edition of this excellent volume appeared in 1939, two of the three original authors have died. Dr. Pagel has now secured the collaboration of Dr. F. A. H. Simmonds, Dr. N. Macdonald and Mr. L. Fatti. The book may thus now be regarded as the contribution of the former Middlesex County Tuberculosis Services to the literature of pulmonary tuberculosis. It is divided into three main parts, pathology, diagnosis and treatment, with

It is plain from the tributes paid to the Irish College at various times in Great Britain that its influence extended far beyond its own country. In Irish medicine, the foundation of this school was of the greatest importance ; for, when the teaching of medicine and surgery had descended to a very low level, the chief motive which prompted Irish surgeons to obtain a Royal Charter was the desire to raise the standard of medical education. Although the College was founded primarily to improve the teaching of anatomy and surgery, its progress has exceeded all the ambitions of its founders.

Dr. Widdess is to be congratulated on the production of an interesting, well-illustrated volume which will have much more than a local appeal, if only because of the contribution made by Dublin surgeons to the progress of medical education in these islands, a contribution which deserves to be more widely known. Specialism appears to be the order of the day in the practice of medicine. The same might apply to the study of the history of medicine. It cannot be given to any one person to know everything about so vast a subject. A series of monographs of this type might do more to encourage the student than large and weighty volumes of many hundreds of pages.

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two shorter sections dealing with prognosis and with epidemiology and prevention. Emphasis in each section is intentionally placed upon the personal experience of the authors. In addition, a fairly full bibliography appears at the end of each chapter.

The section upon pathology contains the maximum amount of information possible in some 200 pages, the text being lavishly endowed with references. The rest of the book is less factual and the order of presentation a little difficult to follow ; for instance, if one wishes to see what is written about some such condition as pulmonary cavitation, one has to refer to various parts of the book, and then one is left wondering if perhaps there are other relevant paragraphs which have escaped notice. It is claimed in the preface that the book may be of particular use to workers in sanatoria and dispensaries and, with this in mind, details of major surgical procedures are not given. This being so, perhaps a little more space might have been devoted to extra-thoracic complications of pulmonary tuberculosis which are fairly frequently encountered, such as ischio-rectal abscess and tuberculous discharge from the ear. The chapters upon out-patient management and rehabilitation are particularly well presented. Many will doubtless disagree with the treatment recommended for haemoptysis, namely, lying the patients down flat and giving them morphine.

This volume is unquestionably the best British work upon pulmonary tuberculosis and should be available at all sanatoria and dispensaries. The price may be regarded by some as a little excessive for a textbook upon a subject which is rapidly changing ; it is hoped that future editions will appear frequently in order to keep the contents up to date.

Neville C. Oswald

## 1440 Tuberculosis in Young Adults. Report on the Prophit Tuberculosis Survey, 1935-1944

Marc Daniels, Frank Ridehalgh, V. H. Springett & I. M. Hall. (Royal College of Physicians.) London: H. K. Lewis & Co. Ltd., 1948. xvi + 227 pages; 58 plates; 22 figures. 25 x 19 cm. £1 10s. [£1.5]

Section A: aims and methods of the Prophit Survey; section B: background of groups examined; section C: initial tuberculin reaction; section D: initial X-ray examination; section E: changes in tuberculin sensitivity during the period of observation; section F: cases of tuberculosis. Clinical analysis; section G: morbidity rates and incidence of tuberculosis arising after entry to Survey; section H: minimal tuberculosis. Aspects and prognosis of the small lesion; section I: discussion. Pathogenesis of pulmonary tuberculosis in young adults; section J: discussion. Epidemiology; section K: measures for the control of pulmonary tuberculosis. Summary and conclusions. Appendices. Bibliography.

The Prophit Tuberculosis Survey was made possible by a generous legacy received by the Royal College of Physicians in 1932 from the trustees of the late Mr. J. M. G. Prophit; its main object was to determine the possibility of picking out those persons or groups of persons most likely to develop tuberculosis. Between 1934 and 1943 observations were made on 10,100 young, presumably healthy, adults; each was given a preliminary Mantoux test and chest x-ray examination. The groups investigated were made up of: (i) contacts—persons living in a family with a case of pulmonary tuberculosis; (ii) controls—mainly office workers; (iii) nurses—those working in hospitals designated group A which admitted all types of patients, including chronic and advanced cases of tuberculosis, and those working in group B hospitals which rarely admitted cases of pulmonary tuberculosis; (iv) medical students, and (v) naval training establishments entrants. Most of those included in the Survey were English from urban areas, with the exception of nurses from group A hospitals, which group had a relatively high percentage of Irish and Welsh girls from rural areas. The mean age of the groups studied was 21 in the groups of nurses, medical students and controls, 18 in the contacts and 16 in the naval entrants.

The initial skin tests showed that in the English group about 85 % of males and 82 to 83 % of females were infected. These figures are higher than those for comparable groups in some parts of America and considerably higher than those for Denmark. The eradication of tuberculosis in cattle seems to have a direct bearing on the degree to which a rural community is infected; in urban areas, this factor is not so evident, as there the influence of human contact is paramount. As might be expected, the percentage of those infected increases with age; it is some 7 to 10 % higher at age 23 than at age 18. Those who have been in contact with tuberculosis show a higher incidence of infection than others; this is maximal where there is exposure to a living parent or sibling with the disease. Next highest come those experiencing recent exposure by nursing tuberculous patients. Contact, to be of significance, must be close, repeated and recent.

The initial chest x-ray examination showed the incidence of active pulmonary tuberculosis in the young adult population to be 0.5 %; nearly 1 % showed evidence of inactive tuberculosis and from 5 to 9 % showed evidence of healed lesions. The relationship between healed lesions and the possible development of active tuberculosis in later life is obscure, but the evidence suggests that several factors are involved, of which race and environment are important. The study of serial radiographs, the fact that a certain percentage of persons, particularly those who are in contact with open tuberculosis, develop stronger reactions to the skin test, and also the fact that there is often a reduction in sensitivity to the skin test in many who are removed from sources of infection, all suggest that re-infection does take place and has a bearing on the development of active lesions.

Of the 10,100 persons observed, 174 developed active tuberculosis during the Survey, giving an annual morbidity rate for females of 11.4 per 1,000 and for males of 6.2 per 1,000. The annual rate of active tuberculous infection arising among persons who had had an initial infection before they entered the Survey was only one-third of the rate found in those who had not been infected before entry. By far the highest morbidity rates were found in contact groups; female contacts, clear on entering the Survey, developed tuberculosis at an annual rate of 32.7 per 1,000. Irish and Welsh nurses in all hospitals showed a high morbidity rate which was 24 times greater than in other nurses; the difference held, irrespective of whether or not they had been initially infected.

The Survey has shown that cases of tuberculosis arise in two groups of young adults: (i) those who receive their primary infection at this age; in these cases, the lesions are a direct consequence of the primary infection; (ii) those who have been infected for some years; these constitute a large proportion of all cases in young adults (57 % in nurses). While there is some evidence that the lesions in these cases are due to lighting-up of old foci of infection, there is also a considerable amount of evidence to show that re-infection from without is responsible for a high proportion of cases.

There are also other factors which have an important bearing on the development of progressive phthisis. These are genetic, environmental and nutritional, and they combine to determine the sum total of resistance of an individual to tuberculous infection, whether it be exogenous or endogenous. Since morbidity is high in young adults not previously infected, it might be concluded that an important reduction of infection in childhood could produce communities of such low resistance that morbidity after infection would be excessively high. It is evident, however, that this will not be the case unless the infection rate in adult life is high; it is, therefore, safe to pursue the aim of reducing sources of infection in the community to a minimum.

The results of the Prophit Survey have justified the labour and expense of the undertaking. The work is open to criticism in that the controls cannot be taken as a fair representation of the average citizen. The differences between the nurses working in group A and in group B hospitals are not sufficiently emphasized, there being social and environmental factors which have an important bearing on the risk of developing active tuberculosis. It is probable that too much weight has been attached to the importance of exposure to infection and insufficient to the factors influencing the development and maintenance of native and acquired resistance in the individual.

F. R. G. Heaf

## 1441 Medicine: Essentials for Practitioners and Students

G. E. Beaumont. Fifth edition. London: J. & A. Churchill Ltd., 1948. xvi + 831 pages; 71 illustrations. 24 x 16 cm. £1 10s. [£1.5]

(i) The alimentary system; (ii) the respiratory system; (iii) the cardiovascular system; (iv) the nervous system; (v) the urinary system; (vi) the haemopoietic system; (vii) the infectious fevers; (viii) infectious diseases of known and doubtful etiology; (ix) the locomotor system; (x) disorders of metabolism; (xi) the ductless glands; (xii) the tropical diseases; (xiii) the parasitic worms; (xiv) diseases due to physical agents; (xv) the poisons. Index.

It is impossible not to admire this volume, compiled by one physician and covering almost the whole of medicine. The work involved in its original production must have been enormous, and the preface to the new edition, listing the sections that have been added or rewritten, bears testimony not only to the advances in medicine but to the industry of the author. Yet it must be admitted that the book is disappointing. This is partly due to the classification of diseases, which must mislead the student. Thus, hepatitis appears as a heading with no mention of infective hepatitis and homologous serum jaundice; these are dealt with later under the heading of jaundice. There are separate accounts of subacute nephritis, of the oedematous type of chronic diffuse glomerulonephritis and of chronic nephrosis; all, apparently, descriptions of the same syndrome. Incidentally, no reference is made to Ellis's classification of nephritis. Hyperthyroidism and thyrotoxicosis are given separate sections, but no clear distinction is drawn between chronic adhesive pericarditis and the post-rheumatic adherent pericardium.

The new edition bears evidence of thorough revision, yet there is still much that might be pruned or altered. Alternative names for diseases, unless of historical interest, might well be excluded, for no student is likely to meet tonsillitis under the name of amygdalitis, or obesity as lipomatosis universalis. It is doubtful whether, today, autogenous vaccines are used in the treatment of delayed resolution in pneumonia or whether sweating is indicated in the treatment of acute nephritis. No mention is made of penicillin in the treatment of perinephric abscess. It is interesting to see that, though the author recommends the modified Meulengracht treatment for patients with haematemesis, the full Sippy diet,

with citrated milk, is still given as the routine treatment for uncomplicated cases of gastric ulcer. Fig. 65, which is stated to show unilateral exophthalmos, is a classical picture of unilateral lid retraction and does not reveal whether exophthalmos is present or not.

In his preface to the 1st edition in 1932, Dr. Beaumont maintained that, if a general physician with charge of general medical wards was expected to teach his students general medicine, then the day of the one-man textbook of medicine had clearly not passed. There is undoubtedly a great need for the general physician, who views his patients as a whole, who knows when to call on his specialist colleagues for assistance and who can pass on to his students his knowledge and experience by the bedside. But, when the student gets home and consults his textbook, he should find the latest, most expert and reliable information on whatever subject he looks up. The day when any single physician can produce a complete textbook of medicine has indeed passed, and such a volume must of necessity be either incomplete or inaccurate, and cannot present an up-to-date account of every disease.

## 1442 Textbook of Medical Treatment, by Various Authors

Edited by D. M. Dunlop, L. S. P. Davidson & J. W. McNee. Fifth edition. Edinburgh: E. & S. Livingstone Ltd., 1949. xvi + 999 pages; 40 figures. 24 × 17 cm. £1 15s. [£1.75]

(i) Infectious diseases; (ii) the sulphonamide drugs; (iii) penicillin; (iv) antihistamine drugs; (v) dehydration and hypochloreaemia; (vi) tuberculosis; (vii) common diseases of the skin; (viii) venereal diseases; (ix) common tropical diseases and helminthic infections; (x) some common disorders in infancy and early childhood; (xi) the care of old people; (xii) industrial diseases; (xiii) metabolic diseases; (xiv) diseases of the ductless glands; (xv) diseases of the blood, spleen and lymphatic glands; (xvi) diseases of the alimentary canal; (xvii) diseases of the liver, gall-bladder and biliary tract, pancreas and peritoneum; (xviii) diseases of the heart and circulation; (xix) diseases of the blood vessels of the limbs and the effects of cold; (xx) diseases of the nose, throat and ear; (xxi) diseases of the respiratory system; (xxii) renal diseases; (xxiii) chronic rheumatic diseases and diseases of bone; (xxiv) diseases of the nervous system; (xxv) psychotherapy in general practice; (xxvi) technical procedures and oxygen therapy. Appendix: table of official preparations with their proprietary equivalents. Index.

The appearance of the 5th edition of this textbook in ten years is proof of the widely-felt need for a volume of this kind. All aspects of treatment, including not only drugs, but also the general management of the patient, are dealt with in a sensible and clear manner, and the style of writing is pleasant and straightforward. It is therefore not surprising that this book has become an indispensable guide to students and practitioners, and there can be few hospitals in this country where a well-thumbed copy does not bear witness to its value to the resident staff.

The chapters on infectious diseases, penicillin, venereal diseases and diseases of the nervous system have been rewritten, and in the other sections there is evidence of careful revision.

The first of the three new chapters deals with the antihistamine drugs. The various substances employed, and their dosage, are described, and there are clear instructions about the chances of success to be expected by their exhibition in allergic and other disease states. The second addition is a chapter on dehydration and hypochloreaemia. It is based on Marriott's Croonian lectures, and gives a lucid summary of the pathological physiology, and the treatment, of water and salt depletion; also, the simple and indispensable Funtus test for urinary chloride is described. More space might however have been given to the practical details of the management of dehydration in infants and children. Professor Aitken contributes an excellent new chapter on the care of old people, beginning with a description of the physical and mental processes of ageing. This is followed by some well-balanced and common-sense advice on problems of accommodation, retirement and alternative interests after retirement. The importance of an adequately balanced dietary regime for the aged is stressed.

It is gratifying to see that the official names of drugs have been used throughout, and that the bewildering, and constantly growing, list of proprietary preparations has been relegated to an appendix. Also, another attempt is made to familiarize the reader with the metric system by giving the metric equivalents in parenthesis after the apothecaries' dosages.

No mention is made of the use of sulphonamide mixtures, para-amino-salicylic acid and the anti-folic acid substances. The details

of the uses and dosage of streptomycin are lacking, but it is inevitable that in a book of this kind the interval between writing and publication should lead to some omissions. These do not in any way detract from the value of this very sound work.

B. Gans

## 1443 Médecine Pratique

Camille Lian et al. Paris: L'Expansion Scientifique Française, 1948. 191 pages; illustrations. 24 × 16 cm.

This volume is a collection of lectures delivered by the staff of the Hôpital Tenon, under the guidance of Professor Lian. The lectures are addressed to residents, postgraduate students and junior physicians, and the contributors maintain a very high level of excellence.

The introduction by the editor, on the history of medicine and the French medical schools, is followed by an article on spontaneous hypoglycaemia by Professor Laroche. Hypoglycaemic states due to pancreatic adenoma, hypophyseal dysfunction, Addison's disease, hepatic failure, and glycogen storage disease are described, in addition to a number of doubtfully investigated "polyglandular adenomatoses" which are said to lead to spontaneous hypoglycaemia. The steps necessary for the investigation of the various syndromes are described and followed by a note on the medical and surgical treatment.

Professor Bernard stresses the importance of tomograms in the localization of pulmonary cavities in the paravertebral gutter, in the apices, under effusions and in pleural thickening, though not much is made of their use in the investigation of neoplasms and intracardiac calcification. The x-ray plates, as elsewhere in the volume, are very badly reproduced.

Professor Haguenu discusses the neurological accidents associated with hypertension, and describes the clinical pictures found in spasm of the cerebral arteries, arterial rupture and cerebral haemorrhage, and cerebral anoxia and softening due to decreased blood flow and cerebral oedema.

This chapter is followed by an excellent monograph on acute leukaemia by G. Marchal. The misleading modes in which the disease may present itself are described, their great diversity being stressed. The frequent aleukaemic course, and the futility of strict subdivision into types, is emphasized. Though not all will agree with the etiological factors enumerated, and though no recent advances in treatment are mentioned, the article is an authoritative review of leukaemia, and contains a good bibliography.

The diagnosis and treatment of glycosuria, by G. Dreyfus, describes different glycosuric states and their investigation. Boulin's abbreviated blood-sugar curve does not seem as good as the Exton Rose test, which is not mentioned, and it appears that Fehling's solution is still used in France. The article ends with a note on the dietary treatment of diabetes.

M. Deparis contributes an article on the epidemiology and prophylaxis of typhoid and paratyphoid fever, and deals with the bacteriology, cultural characteristics, agglutination reactions and mode of spread of the relevant bacteria. His advice on management, disinfection and prevention follows standard lines. A short review of recent French epidemics and a list of famous names associated with the history of the disease are of interest.

The symptoms, radiological signs and differential diagnosis of gastric ulcers of the lesser curvature are discussed by P. Hillemand. Unfortunately there are no statistics on the incidence of peptic ulcer in France, which would have been of interest. The author accepts unquestioningly the possibility of carcinomatous change, and his ideas of treatment differ markedly from Anglo-American methods.

R. Even describes the steps in the early diagnosis of carcinoma of the bronchus, which follow customary lines, including microscopy of the sputum for carcinoma cells. Diagnostic lung puncture is advocated rather than thoracotomy. The article ends with a comparison of French and American postoperative survival rates, and makes the statement that American statistics of bronchial carcinoma include benign neoplasms.

The early diagnosis of pregnancy by clinical examination and hormonal test (several cases being described in detail) is discussed by F. Lepage, and the last article in the volume, by J. Voisin, describes the ophthalmoscopic findings in hypertension.

B. Gans

## 1444 Proceedings of the Annual Meeting, 1948

British Medical Association. London: Butterworth & Co. Ltd., 1949. xxvi + 415 pages; 81 figures. 25 × 16 cm. £1 15s. [£1.75]

(i) Section of Medicine; (ii) Section of Surgery; (iii) Section of Obstetrics and Gynaecology; (iv) Section of Anaesthetics; (v) Section of Diseases of the Chest; (vi) Section of Orthopaedics; (vii) Section of Pathology and Bacteriology; (viii) Section of Physiology and Biochemistry; (ix) Section of Preventive Medicine; (x) Section of Dermatology; (xi) Section of Child Health; (xii) Section of Radiology; (xiii) Section of Occupational Health; (xiv) Section of Ophthalmology; (xv) Section of Neurology and Psychiatry; (xvi) Section of Nutrition; (xvii) Section of Oto-Rhino-Laryngology; (xviii) Section of Anatomy and Anthropology; (xix) Section of Pharmacology; (xx) popular lecture. Index.

To the doctor with a wide range of interests—the “universalist” of Sir George Schuster—an annual meeting of a national medical association must be an unsatisfactory sort of entertainment. The scientific fare is so concentrated and so many Section meetings proceed simultaneously that his only hope of obtaining the maximum of enjoyment is by reading a bound volume of the proceedings. Such a person will find much to interest him in the volume here reviewed, for most of the lecturers deal with subjects of general appeal.

Thus, Himsworth extols the virtues of the thiouracil derivatives in hyperthyroidism in a lucid and charming style, and Whitby uses the macrocytic anaemias to point once again the moral that diagnosis precedes treatment. Denis Browne's paper on tuberculous adenitis is most stimulating and provocative; every general practitioner would benefit from reading it.

In Smithwick's discussion on the late results of operation for hypertension he confines his remarks to a selected group. Even so, one wonders how sympathectomy can improve the normal electrocardiogram in 14.5 per cent of cases.

The obstetricians and gynaecologists have chosen important and topical subjects for their discussions. The problem of infertility is considered from all angles, with the inevitable references to donor insemination in its legal aspects. As regards operative treatment of sterility, it is interesting to speculate on how many of the “8 to 18 per cent” said to benefit from operation on the Fallopian tubes would have eventually conceived in any case. Analgesia in labour is dealt with fully and Nixon stresses the importance of encouraging the pregnant woman. The third stage of labour is sure to prove a good debating ground. To interfere or not to interfere is the question. Sheehan makes some observations which suggest that non-intervention when the third stage is prolonged does not reduce the mortality rate.

It is clearly impossible to mention all the papers read. Many will enjoy Batten's down-to-earth chat on the treatment of pneumonia, and Capcner's advocacy of conservatism in treatment of the prolapsed intervertebral disk gives food for thought. The discussions on poliomyelitis and on its relation to tonsillectomy are timely. In the long section on human relations in industry, perhaps the most telling remark made was that a great obstacle in the development of an industrial medical service is the attitude of the healthy individual to the doctor.

Lastly, for those whose reading is not governed by purely utilitarian considerations, may we commend the short paper by Wood Jones, in which he is moved to righteous anger by the shortcomings of Darwin and Huxley and demonstrates that the present position of primate anatomy is highly unsatisfactory.

S. S. B. Gilder

## 1445 Clinical Endocrinology: for Practitioners and Students

Laurence Martin & Martin Hynes. London: J. & A. Churchill Ltd., 1948. viii + 222 pages; 33 figures. 22 × 14 cm. 15s. [£0.75]

(i) The pituitary; (ii) Frölich's syndrome and obesity; (iii) the pineal body; (iv) the thyroid gland; (v) the parathyroid glands; (vi) the thymus; (vii) the adrenal glands; (viii) the testes; (ix) the ovary; (x) the breast; (xi) hormone implantation. Index.

A few months ago I met a general practitioner who had been at Cambridge with me a quarter of a century ago. We exchanged greetings and polite mutual enquiries during which he said: “Endocrinology must be a very rare speciality because I have a very large practice and never see any endocrine cases.” I felt that his medical education must have had many gaps and that he had deceived the

examiners because his degree of mind-blindness was unusually high. But even he will want to learn something about endocrinology now that it has dramatically entered the field of rheumatism and is flirting with, or being seduced by, almost every branch of medicine and surgery. This book by Martin & Hynes could not be bettered for a simple practical introduction to a complex subject, especially written for the practitioner and student. It is a product of two Cambridge physicians, and Sir Lionel Whitby rightly finds it easy to write an appreciative foreword, which the reviewer has no hesitation in warmly endorsing as an endocrinologist. However, it should be pointed out that this convenient book of 200 pages is not suitable for candidates for the higher medical examinations, who will, for example, find themselves (after reading it) unable to discuss adequately the physiological and pathological differences revealed by the urinary assay of 11-oxosteroids and 17-ketosteroids in Cushing's disease and simple virilism respectively.

S. L. Simpson

## 1446 The Practice of Endocrinology

Edited by Raymond Greene. London: Eyre & Spottiswoode Ltd., 1948. (The Practitioner Textbooks.) xix + 366 pages; 53 plates; 19 figures. 25 × 15 cm. £2 12s. 6d. [£2.625]

(i) Introduction; (ii) the hypothalamus; (iii) the pituitary gland; (iv) the adrenal glands; (v) sex and reproduction; (vi) the thyroid gland; (vii) carbohydrate metabolism and diabetes mellitus; (viii) calcium metabolism and the parathyroid glands; (ix) the thymus and pineal body; (x) adiposity. Index.

This book is a notable addition to English books on endocrinology. It is a little difficult to believe that it was intended for general practitioners (as the preface says) because the presentation on the whole is somewhat involved and, in sections, scientifically academic, though in others the presentation is clear and brief. There are hardly sufficient clinical illustrations for a book of this size, and pages of uninterrupted print, sometimes without subdivisional headings, appear fatiguing. Nevertheless the subject-matter is comprehensive and up to date and should prove helpful to the careful reader. A. C. Crooke, an authority on pituitary cytology, has undertaken one chapter on this gland with conspicuous success. He also contributes a very detailed chapter on the adrenals, where the clinical aspect is relatively overweighed by more theoretical and experimental considerations. The chapter on sex and reproduction by the editor, Raymond Greene, contains a valuable biological introduction including the description and interpretation of several chemical and biological tests. His chapter on the thyroid has all the virtues of straightforward clinical presentation. Lawrence on diabetes could not be other than direct and lucid and Hunter on calcium and the parathyroids scintillates easily in a field in which he has pioneered. The experimental approach is well represented by Robson in a chapter on sex and reproduction and by Rundle on the thyroid gland; Sandifer deals with brevity and clarity on the extirpation of the thymus in myasthenia gravis. Altogether these sections comprise a valuable symposium which will probably achieve a better balance and co-ordination with a subsequent edition; the latter will certainly be forthcoming and welcome.

S. L. Simpson

## 1447 Sterility and Impaired Fertility: Pathogenesis, Investigation &amp; Treatment

Cedric Lane-Roberts, Albert Sharman, Kenneth Walker, B. P. Wiesner & Mary Barton. Second edition. London: Hamish Hamilton Medical Books, 1948. xxiii + 400 pages; 2 plates; 96 figures. 22 × 14 cm. £1 4s. [£1.2]

(i) General survey of the problem; (ii) the male factor in childless marriage; (iii) the constitution of semen; (iv) assay of male fertility; (v) the male reproductive mechanism and its disturbances; (vi) treatment of male sterility; (vii) sterility in the female; (viii) the treatment of female sterility. Appendix. References. Index.

This second edition is of far greater value than the first, in that it deals with many controversial matters and gives details of diagnosis and treatment which have been of proven value in the practice of the authors, the team of contributors having been much strengthened by the addition of Dr. Mary Barton. This is an excellent book which cannot fail to be of great assistance to all practitioners, for it is unique in this country.



The male side of the problem of sterility is first very thoroughly discussed and dealt with most helpfully. We are glad to read that the authors particularly emphasize the importance of the cervical mucus as a factor for observation, though it is not made clear that the probable cause of inimical changes in this mucus is very often the use of chemical contraceptives. It is doubtful whether sulpha compounds or antibiotics can be as useful as stated for intracervical conditions.

Much stress is laid upon the importance of ovulation and there are some excellent photographs of endometrial biopsies. This technique, adequately described, is by no means foolproof; it may, therefore, be thought wise to point out its dangers in the next edition. Only recently Halbrecht of Tel Aviv has recorded five cases of severe pelvic peritonitis subsequent to endometrial biopsy in his clinic.

The determination of tubal patency by gas or oil is well described. There are excellent illustrations denoting kymographic results, but the tracing on p. 242 is surely that of a case of hypoplasia, for Rubin teaches us that low oscillations under a pressure of 50 mm. Hg are characteristic of this condition and that such a recording gives a poor prognosis.

The chapter on insemination and cervical invasion is particularly good; that on treatment could, we think, be made more comprehensible if the hormonal approach to the subject could be made more clear, for nothing annoys the practitioner more than half a dozen titles being given to the same preparations on half a dozen pages.

There is one other criticism, namely that the published findings of Bacsich, Sharman & Wyburn, quoted on p. 9, are flatly contradicted by those of Goldblatt and Kurzrok on p. 47. It would seem therefore that the incidence and cure of hypoplasia, upon which the authors rightly lay great stress, depends very much upon the contact of healthy semen with the vaginal and cervical mucous membrane.

Finally we suggest that the findings of welfare clinics staffed by busy and inexpert practitioners are of no value on the matter of voluntary and involuntary sterility, for let not those words of Rubin be forgotten: "Contraceptive methods undoubtedly affect fertility for longer or shorter periods after their use has been stopped."

V. B. Green-Armytage

#### 1448 Sexual Disorders in the Male

Kenneth Walker & Eric B. Strauss. Third revised edition. London: Hamish Hamilton Medical Books, 1948. xiii + 260 pages; 10 figures. 22 x 14 cm. 15s. [£0.75]

(i) The physiology of sex; (ii) the male critical age; (iii) the classification of impotence; (iv) organic or secondary impotence; (v) psychogenic or primary impotence; (vi) premature ejaculation; (vii) the examination of the patient and the principles of treatment; (viii) the female partner; (ix) endocrinological and general medical treatment of impotence; (x) surgical treatment of impotence; (xi) priapism; (xii) psycho-sexual development; (xiii) the psychopathology of sexual deviations; (xiv) psychotherapy of the commoner sexual neuroses and deviations; (xv) masturbation; (xvi) pollutions; (xvii) sexual difficulties in marriage. Index.

It has taken several years and many impressions for this book to reach its present size and excellence. Indeed, Mr. Walker and Dr. Strauss have produced a volume of 250 pages, easy to read and light to handle, which cannot fail to be of extreme value, not only to consultants, but to all practitioners.

In the present conditions of practice there is neither the time nor the privacy for dealing with the very large number of sex problems in men, which are so often hidden or on the surface waiting for the good doctor to interpret. What we like about this volume is that there is very little pharmacopoeial or hormonal dosage. Much more important, the doctor is given a perfectly clear-cut picture of the psychosomatic problems which arise so plentifully.

Various common sexual deviations or disorders are clearly defined. Sympathetic treatment is advocated; if the male patient feels that his doctor really understands his case, half the battle is won.

The reviewer has one criticism to make, namely, that neither in the chapter on priapism nor in that on psychosexual development is there any mention of the value of oestrogens such as stilboestrol or ethinyl oestradiol when dealing with sudden or constant increase of libido. In recent years fairly large doses of these have proved to be of great value for such conditions whether in the adolescent, adult or senile patient.

V. B. Green-Armytage

#### 1449 Rheumatic Diseases. Proposed Scheme for the Development of a Diagnostic Treatment and Research Centre at Harrogate

Leeds Regional Hospital Board. Leeds: Leeds Regional Hospital Board, 1948. 31 pages; maps; illustrations. 31 x 25 cm.

This very handsomely produced brochure is published by the Leeds Regional Hospital Board to explain and advocate their progressive scheme for the organization of a large-scale centre for the diagnosis and treatment of sufferers from the chronic rheumatic diseases and for research into the causative factors. This centre is to be located in Harrogate where a full-time Director of Research and his staff have already been installed at the Royal Bath Hospital. The present plan advocates the purchase of several hotels and other buildings in order to extend the availability of the resources of the Royal Baths and of the Hospital.

The scheme is under the direction of the Regional Board, with the advantage of advice from many other interested bodies such as the Harrogate Town Council, the Board of Governors of the Hospital, and a special subcommittee of the Rheumatism Advisory Board of the University of Leeds—but not apparently of the Empire Rheumatism Council. The scheme itself follows the lines laid down by the Cohen Committee (1944), and consists of central and annex hospital accommodation in association with the Leeds teaching hospital centre. In addition there will be developed, elsewhere in the Region but linked with the centre, a number of peripheral rheumatism clinics. On this basis research beds and laboratories will be developed from the present very active nucleus. It is also clear from this report that the scheme will include the provision of beds for cases requiring prolonged rehabilitation.

Finally, plans are envisaged for the establishment of a school of physiotherapy, presumably under the auspices of the Chartered Society of Physiotherapy. This seems to be a progressive addition to what promises to be a large and imaginative scheme. The need for organized treatment centres for the sufferers from chronic rheumatic diseases is very urgent, and it is to be hoped that the Minister of Health, to whom this brochure is addressed, may be found willing to give assistance in spite of his present financial stringency!

W. S. C. Capeman

#### 1450 II<sup>e</sup> Conférence, 24-27 Juin 1948. Le Rhumatisme Chronique Dégénératif. I. Rapports: II. Atlas

Conférence Scientifique Internationale d'Aix-les-Bains. Chambéry: Imprimeries Réunies de Chambéry, 1948. Rapports: 690 pages. 24 x 16 cm. Atlas: 82 plates; 24 x 16 cm.

(i) Généralités, historique; (ii) étiologie, pathogénie, anatomie pathologique; (iii) séméiologie, diagnostic; (iv) thérapeutique.

This Conference was held at Aix-les-Bains in June 1948, under the presidency of Professor P. Leriche, and the proceedings have now been published.

The first subject dealt with at the Conference was osteoarthritis; this was covered exhaustively by numerous papers. Treatment by drugs, physiotherapy and balneotherapy were fields in which few innovations were offered. Throughout the proceedings there was a tendency to stress the distinction between degenerative and inflammatory joint changes by reserving the term "arthrosis" for the former and "arthritis" for the latter; Martin & Junet, however, strayed from the straight and narrow path by suggesting that there was no clear distinction between the two, and that the one may merge into the other. In support of their view, they stated that the erythrocyte sedimentation rate is frequently accelerated, to a moderate extent, in osteoarthritis of the hip. Coste & Forestier agreed with this observation but added the warning that after the age of 55 the sedimentation rate, at least on the Westergren scale, may be accelerated in perfectly healthy subjects. Since a large proportion of sufferers come within this age-group and since traumatic effusions are not uncommon, the unorthodox views of Martin & Junet may perhaps be partly explained by these facts.

Lièvre & Bloch-Michel discussed pain in the upper extremity and "herniated disks"; they began by suggesting that cervical ribs do not cause pain and that this is being increasingly recognized.



In fact, all the ills previously attributed to them have been transferred to the scalenus anterior syndrome. Many of the protagonists of this syndrome, however, admit that the mechanism involved is one of costoclavicular compression by contraction of the scaleni. Lièvre & Bloch-Michel deal with the costoclavicular syndrome, which is so frequently diagnosed, as rudely as they deal with cervical ribs, pointing out that various criteria used in diagnosis, for example the loss of the radial pulse on certain manoeuvres, can be reproduced in the healthy subject. Their iconoclastic arguments, in fact, are so well marshalled that the bewildered reader, having seen his idols destroyed one by one, is ready to clutch at the straw which is, finally, proffered in the shape of "damaged intervertebral disk." This, they hint, will explain all troubles previously ascribed to other causes. However, not everyone will agree that once this diagnosis is firmly established operation is the only answer.

A good deal of time was spent discussing osteoarthritis of the hip-joint, the congenital and traumatic conditions which predispose to it, and the various methods of relieving pain and disability. Ravault & Graber-Duvernay made a plea for early diagnosis by stereoscopic x-ray examination and Timbrell Fisher favoured manipulation and stretching of the capsule under anaesthesia. Arthrodesis and arthroplasty, especially the "cup" variety, received due recognition but are obviously not applicable to all cases. The drastic methods frequently used abroad for the relief of pain may be illustrated by the work of Kahlmeter in Sweden. He has always advised rest in bed in the acute stage and deep x-ray treatment to the tendinous insertions of the adductors in the pelvis and of the glutei in the region of the great trochanter. The work of Reis and others on referred pain in this condition has made him decide in favour of posterior rhizotomy of the third and fourth lumbar nerves. He admits that pain frequently returns after several months but states that the period of painlessness enables him to institute energetic joint movements in addition to deep x-ray therapy. Tavernier favours a more direct approach and practises denervation—an operation which, he claims, can be applied to other joints such as the knee and shoulder. Section of the obturator nerve by a crural or iliac approach was found to be insufficient and he has gradually evolved a technique of one inguinal and one posterior incision in the buttock without any attempt to save motor fibres. Even in his skilled hands, however, a number of cases fail to get relief and have to undergo another operation. It has been suggested that any beneficial results obtained from stretching of the capsule (and the breaking down of adhesions) and capsulectomy are due to denervation. One would have expected, therefore, that the most direct approach of all (the injection of analgesic substances into and around the joint) would have received much attention, but the attitude adopted was one of caution. Copeman & Tegner referred to the work of Grant Waugh and suggested that serious thought should be given to the possibility of using such injections to prevent the onset of osteoarthritis in joints predisposed to it, or, at least, to limit its spread. The impression one obtains is that there is no unanimity on the subject of osteoarthritis of the hip and that the treatment adopted, as in many other conditions, depends on the views of the individual practitioner and his skill in one particular form of therapy.

The report of this Conference is in two parts. In the first and larger part are given the papers read, together with their lists of references: this volume is well indexed and individual authors and their work can be easily traced. Unfortunately the French text is marred by errors in spelling, of which a few examples will suffice. Reference to the "Journal of bones and joints of Surgery" should raise no bibliographical problems, but the "Leisch. f. Rlm. med." is more difficult to find; "Peto Peau" represents the name of a stronghold of rheumatology in London (Peto Place) and "Blondell Baukhart" that of the distinguished British surgeon, Blundell Bankart. The second smaller volume is entirely devoted to photographs, skiagrams, and twelve drawings by Tavernier and his co-workers to illustrate their operation of joint denervation:

W. S. C. Copeman

## 1451 Skin Diseases in General Practice

F. Roy Bettley. London: Eyre & Spottiswoode Ltd., 1949. (The Practitioner Handbooks.) 260 pages; 96 figures. 22 x 14 cm. £1 1s. [£1.05]

(i) Introduction; (ii) eczema—definition and diagnosis; (iii) contact eczema; (iv) constitutional eczema; (v) eczema—treatment and prognosis; (vi) infantile

eczema and flexural eczema; (vii) occupational dermatoses; (viii) the seborrhoeic state and acne vulgaris; (ix) seborrhoeic dermatitis; (x) psoriasis; (xi) impetigo contagiosa; (xii) fungus infections of the skin; (xiii) rosacea; (xiv) perineal pruritus; (xv) alopecia areata; (xvi) parasitic diseases; (xvii) naevi; (xviii) epithelial tumours—verruca and epithelioma. Appendix. Index.

This book has been written for general practitioners and Dr. Bettley has excluded all but the common skin diseases on that account. Unfortunately he has also excluded consideration of chilblains, leg ulcers, papular urticaria and the treatment of boils. Most general practitioners are so busy that they use their medical libraries only for reference when they require help in the diagnosis of some unusual condition or advice as to current therapeutic practice. It is in relation to the diagnosis of the less common, less familiar, conditions that the medical encyclopaedia or the larger special textbook is useful. A general practitioner considering whether a patient might have such a condition as erythema multiforme, lupus vulgaris or lichen planus would get no assistance from this book, although these are not rare diseases.

It does, however, summarize current views about some of the common skin diseases and gives details of their treatment. The chapters on the seborrhoeic state and on industrial dermatoses will be found particularly useful. The author mentions nothing of the importance of the parental background and of the psychological factors in infantile eczema in spite of the work of Barber, Woodhead, and others. He stresses the importance of allergy in eczema—many would think he over-stresses it—and discusses desensitization, which has little importance in general practice. The carrying out and interpretation of patch-tests is sometimes a complex affair and it seems doubtful whether it is justifiable to devote 18 pages to the subject in a book of this type.

Treatment is adequately considered in regard to most of the conditions dealt with, though there is no mention of tar baths or the use of dithranol in paste for psoriasis. The danger of carcinoma due to long-continued exhibition of arsenic is omitted, although its use in chronic cases is described. The risk of sensitization by the local application of penicillin and anaesthetic ointments might be emphasized more strongly.

There is, however, much useful information in this book and many of the illustrations, of which there are 96, are excellent.

S. T. Anning

## 1452 Nutritional Macrocytic Anaemia

George Sippe. London: published on behalf of the Government of Mauritius by the Crown Agents for the Colonies, 1947. vii + 76 pages; 12 illustrations. 25 x 16 cm. £1 1s. [£1.05]

Part I: nutritional macrocytic anaemia. Part II: aetiology and pathogenesis. Part III: pathology. Part IV: symptoms and physical findings. Part V: the blood findings. Part VI: diagnosis and differential diagnosis. Part VII: prognosis. Part VIII: treatment. Appendix I: Mauritius. Appendix II: technique. Appendix III: some particulars from fifty of the cases of nutritional macrocytic anaemia investigated in Mauritius. References.

This monograph is based on extensive experience of nutritional macrocytic anaemia in Mauritius. It is, indisputably, a model of what such a study should be, and has the outstanding merit of being brief and yet complete. Of special importance is the discussion of the part played by chronic malarial infection, which can convert potential macrocytic anaemia (due to defective nutrition) into the full picture of the disease, while it can also aggravate it, if already present. Malaria appears "to exert its destructive influence partly by direct parasitization of the red cells, partly by a toxic effect on the bone marrow, but mainly by hypertrophy of the reticulo-endothelial system, which then attacks the abnormal erythrocytes." Hookworm, on the other hand, is more likely to precipitate hypochromic nutritional macrocytic anaemia.

There is a short but excellent description of the bone marrow, which is said to contain both the megaloblastic and the normoblastic series, presumably because the failure of haemopoietic factor is not absolute, being, however, accentuated by constant haemolysis due to the enlarged malarial spleen. Perhaps the most valuable section is the clinical one, for the reason that no better one has ever been published, although Sippe emphasizes the need for laboratory investigation in order to assess the part played by malarial and hookworm infection. Although the book is, naturally, of special interest to physicians in the tropics, it is of great value to all those who meet cases of nutritional anaemia.

A. Piney

# 1453 Die pathologisch-anatomischen Grundlagen der Allergie

Wilhelm Eickhoff. Stuttgart: Georg Thieme, 1948. 95 pages; 40 illustrations. 21 x 14 cm. 8.40 Mk.

(i) Tierexperimentelle Allergie; (ii) tierexperimentelle Parallerergie; (iii) menschliche Impfallergie.

This short book, which is intended for undergraduates, is divided into three parts. The importance of allergy is illustrated by the example of rheumatism. Various terms and phenomena related to allergy, anaphylaxis and sensitization are explained partly by experiments on animals and partly by clinical experience. Though the symptoms and course of allergy are known the exact etiology remains unknown; for this reason many explanations have been put forward and most of these have been unsatisfactory. The author tends to accept Ehrlich's side-chain theory in order to understand immunology. In the second part parallerergic reactions are discussed and among the inflammatory parallerergic reactions what is now called collagenosis is mentioned. The last part deals with vaccination, serum-therapy, anaphylactic shock in man and idiosyncrasy. An attempt has been made to document allergic phenomena by histological preparations, but only a few of the photomicrographs are really good. An indication of the magnification and of the stain would surely be welcome in a book for students. Those looking for a bibliography are wisely referred to the larger books.

E. Neumark

# 1454 Essentials of Fevers

Gerald E. Breen. Second edition. Edinburgh: E. & S. Livingstone Ltd., 1948. xi + 351 pages; 16 plates; 24 figures. 19 x 12 cm. 15s. [£0.75]

(i) General features of infection; (ii) results of infection—disease and immunity; serum and serum reactions; (iii) spread and control of infection—elementary epidemiology; preventive isolation; (iv) examination and treatment of fever patients—prognosis in fevers; (v) the streptococcal infections—scarlet fever, erysipelas, and puerperal pyrexia; (vi) diphtheria; (vii) the intestinal infections—enteric, bacillary dysentery, and gastro-enteritis; (viii) variola, vaccinia, and varicella; (ix) infections of the nervous system—cerebro-spinal fever, poliomyelitis; (x) the respiratory infections—measles and whooping cough; note on coughs; (xi) rubella, glandular fever and mumps; (xii) typhus fever and influenza; (xiii) miscellaneous—infectious disease and the law; mechanical artificial respiration; some common mistakes; typical charts; table of incubation and segregation periods. Index.

A book which is confined to the "essentials" of a subject can never be easy to write. Successful compression requires the touch of a master. No wise student attempts to learn only the essentials of a subject; he knows that he can learn the essentials only by reading and learning more than these. This book cannot be recommended to the serious medical student. It is of the "chatty" type without references, without appraisal of the value of evidence from different sources, and full of general statements which, however humourously expressed at times, may be only the opinion of the author or of anybody for that matter: rarely is any clue provided as to the value which can or should be placed upon them.

Certain sections, however, bear the stamp of intimate personal experience and so are valuable to any medical reader. These include the short statements on epidemiology, serum sensitivity, the examination of patients and the management of the febrile state. Apart from these and a few other sections, the book would seem to be more suitable for nurses than for medical students. Indeed the form of writing suggests that the book has grown out of a set of lectures for nurses rather than from personal experience of the teaching of students. The author under-estimates the enquiring mind of the medical student of today when he states in his preface that the book contains more than enough theory to meet the student's needs.

There is also evident in this book a lack of acquaintance with the more modern conceptions of clinical work in fevers. It is surprising to find in the chapters on scarlet fever and measles little or nothing said about acute otitis media and no indication given of its importance to the individual and community, or of its treatment and prophylaxis. The chapter on cerebro-spinal fever is out of date, an example being the apparent recommendation to search for carriers and to segregate them. The chapter on poliomyelitis is probably the best example in the book of compression merely leading to confusion. Little knowledge of the haematology of

whooping cough is shown by the statement that the blood may show up to 16,000 white cells. Nothing is said about whooping cough in young infants and practically nothing about pulmonary collapse in this disease.

The 17 coloured plates are a novel feature of this book; these are not photographs but representations drawn and coloured by the author. This is a brave attempt to depict the eruptions and other clinical manifestations of the exanthemata, but it cannot be said to be quite successful. Although on the whole these pictures convey approximately the desired impressions, they are in some respects misleading. If they have considerably raised the cost of the book it is doubtful if they are worth it.

It is to be hoped that this book will not be widely read abroad for it does not represent the teaching of fevers in this country at its best.

H. S. B.

# 1455 An Inquiry into the Extent to which Cancer Patients in Great Britain Receive Radiotherapy

Report Based on Information Supplied to the National Radium Commission by National and Regional Radium Centres and London Teaching Hospitals

Margaret Tod. Altrincham: John Sherratt & Sons [1949]. 48 pages. 24 x 15 cm. 3s. 6d. [£0.175]

This valuable inquiry, carried out for the National Radium Commission, attempts to estimate the number of patients who need treatment by radiotherapy, and the number now receiving treatment, and so to indicate how far the needs of the population in this respect are being met.

The task was made difficult by the fact that there are no adequate morbidity figures for cancer at the various sites, and that the mortality figures from site to site are not very accurate even if the total figure for the country as a whole is fairly near the truth. Schemes for cancer registration have been used as a check upon the mortality figures in an attempt to estimate the incidence rates. These however tend to include a proportion of patients coming from outside the region served so that the population at risk is not accurately known, and patients dying from cancer without ever attending a hospital are not included in these registration surveys. Incidence rates found in other parts of the world are quoted for comparison. The incidence has also been calculated for the various sites on the basis of an estimate of the number of patients with cancer who are cured added to those who die of the disease.

It will be seen how difficult it is to obtain accurate figures. Those set out in this inquiry would seem to be as near to the truth as may be expected at present. It seems more likely that they err on the low side rather than the reverse.

The inquiry then deals with the estimate of the number of patients who need radiotherapy. A questionnaire was sent to radiotherapists all over the country and replies were received either on the basis of the percentage of cases by site which the radiotherapist thought should be treated, or on the basis of the number of cases seen and the number which did actually receive treatment. The more detailed replies showed the proportion of cases treated by surgery, the proportion by radiotherapy and the proportion that received no treatment. The conclusions of this section are that there are 86,600 cases of cancer in England and Wales per annum, that 40 per cent need radiotherapy, and that the number of cases requiring radiotherapy per million, per annum, is 840.

The next section deals with the number of cases treated by radiotherapy in hospitals recognized by the National Radium Commission. This is a factual survey based on returns and forms the basis for the comparison between the estimated number needing treatment and the number actually treated. The conclusions are that 77 per cent of those estimated to need treatment receive it, and that the number of patients who receive palliative radiotherapy is still too low, owing rather to a shortage of beds than to a shortage of radium or x-ray equipment.

This report will prove to be of great value to those whose duty it is to provide adequate treatment for cancer in a large population. It is also of interest in a much wider field, being an illuminating commentary on the way in which people with cancer in this country are treated today.

D. W. Smithers

1456 **Les Hématodermies**

P. de Graciansky & André Paraf. Paris: Masson & Cie, 1949.  
227 pages; 22 figures. 25 × 17 cm. 850 fr.

Introduction. (i) Le derme hématopoïétique; (ii) physiopathologie des organes hématopoïétiques; (iii) la métaplasie des organes hématopoïétiques. I. Les leucoses. (iv) Les leucoses lymphoïdes; (v) les leucoses myéloïdes; (vi) les leucoblastoses; (vii) les leucoses tumorales; (viii) le myélome multiple (maladie de Kahler). Les leucoses plasmocytaires. II. Les réticuloses. (ix) Les manifestations cutanées des réticuloses; (x) la maladie de Kaposi; (xi) l'urticaire pigmentaire. III. Les granulomatoses. (xii) Le mycosis fongique; (xiii) la lymphogranulomatose maligne de Patau-Sternberg; (xiv) les granulomes éosinophiliques. Conclusions générales. (xv) Considérations sur la nosologie des hématodermies; (xvi) traitement des hématodermies. Index alphabétique des noms d'auteurs. Index alphabétique des matières.

An attempt has been made in this book to classify the many disorders in which blood changes coincide with changes in the skin. For a long time atypical disorders in this group have presented difficulties and they are here grouped under three headings, the leucoses, reticuloses and granulomatoses. Each has many subdivisions.

The skin is involved in these diseases essentially by infiltration but in some cases such infiltration appears to be independent of any disease elsewhere. In some disorders it is difficult to distinguish between hyperplastic and neoplastic changes. In certain well-known skin disorders various associated diseases of the blood are recorded, but there is no certain evidence in these that the two are related. Kaposi's sarcoma and mycosis fungoides are given as examples.

The morphology of some of these skin disorders does not permit exact differentiation of the many conditions caused by proliferation of the undifferentiated mesenchyme. The rate of development may give some information on etiology; inferences may also be drawn from the series of successive but different appearances sometimes observed, such as a reticulosis with a leucosis preceding a Hodgkin's granuloma or the association of a granulomatous disorder with a leucosis.

It is concluded that in the present state of knowledge any classification must be provisional and unsatisfactory. Nevertheless, the authors appear to have made a useful summary in this field.

G. C. Pether

1457 **Medical Photography, Radiographic and Clinical**

T. A. Longmore. Fourth edition. London: The Focal Press, 1949. 1,008 pages; 120 plates; 320 figures. 19 × 13 cm. £2 10s. [£2.5]

(i) The photographic process; (ii) photographic considerations in radiography; (iii) clinical photography; (iv) clinical phototechnique; (v) reproduction and processing; (vi) colour photography; (vii) special techniques; (viii) appendix. Index.

This 4th edition, published after a long interval, is a somewhat massive volume, largely because the author has attempted to take the reader through the principles of medical photography, across the field of radiography, and up through the wide range of clinical photography to the heights of photomicrography.

It is clearly designed for student radiographers, who, in addition to their radiographic training, are expected to have a working knowledge of medical photography. The writer of this review is not qualified to judge the radiographic section. Owing to the rapid growth of radiography and medical photography, it is unusual to find an individual who can deal adequately with both subjects.

Mr. Longmore is unquestionably a first-class radiographer and photographer, but I cannot help thinking that his hospital experience of medical photography has been somewhat limited. Much of his teaching is theoretical; the basis for it, no doubt, is derived from experiments using selected live models. This inevitably leads to the introduction of a number of questionable recommendations, of which the following are examples.

The standardization of positioning of patients, which is here described in detail, though very necessary in many respects, should not involve the use of gadgets that tend to frighten the patient. In any case, to prolong the time occupied in preparation, with the patient possibly getting restive (as sometimes happens), is fatal. Once this occurs, the photographer's problems increase a hundred-fold.

Standardized lighting is also recommended. Such lighting in the photographic department of a general hospital can only lead to a large proportion of good photographs, that are clinically useless because they do not demonstrate the condition.

Filters are indicated in some circumstances in clinical photography, but the average patient is unable to keep still for the inevitably longer exposure which is required when a filter is used.

There are a number of very good photographic illustrations, almost entirely the work of Miss M. H. Shaw and Mrs. M. Crossley. A larger number of the author's pictures would perhaps have been more suitable. However, there are a great many excellent diagrams and charts.

In a very brief chapter on photomicrography the author infers that only a few departments need to consider this subject at all seriously and that a simple piece of apparatus will cover the needs of the hospital photographer. In support of this, it is true that most medical photographic departments either do not touch photomicrography, or else do very little, using elementary equipment and usually obtaining poor results. It is left to a mere handful of workers to produce first-class work. To me this is very strange; in each of the four departments with which I have been associated photomicrography has been of primary importance.

Summing up, this volume can best be described as a guide to medical photography. Apart from student radiographers, it may well help anyone who contemplates entering the field of medical photography to get a general insight into what will be required. The student medical photographer should not, however, regard this book as authoritative.

E. Victor Willmott

## SURGERY

1458

## OPHTHALMOLOGY : A DEFINITIVE ACCOUNT

W. J. B. RIDDELL F.R.S.Ed. M.D.

*Tennent Professor of Ophthalmology  
University of Glasgow*

About twenty-five years ago papers of fundamental importance to the elucidation of the physiological problems peculiar to the eye began to appear in the literature under the name of Duke-Elder; these were paralleled by clinical contributions displaying the application of a scientific training to the treatment of the human patient. It was soon apparent that a mind of outstanding brilliance was at work, summarizing, co-ordinating and focusing the basic subjects upon which our knowledge of ophthalmology is built. In 1932 the first volume of this textbook made its appearance and was immediately welcomed as a major contribution to the medical literature of the world. The original intention was to complete the work in three volumes but, as the panorama contained within the author's mind developed and unrolled, it became necessary to increase the scale of the whole project. This volume<sup>1</sup> is to be followed by a fifth on the ocular adnexa and injuries. A sixth and final volume will be devoted to operative surgery.

A revised edition of the first volume appeared just before the war when the opportunity was taken to "bring up to date certain sections wherein fundamental advances in knowledge had rendered the original text misleading." The development, form and function of the visual apparatus are the topics described with delightful lucidity. This book is difficult to lay down because the reader is stimulated and enthralled by the collateral attractions that he finds: a short biography of some well-known authority, a few sentences indicating the significance to the clinician of a basic physiological observation, a paragraph in smaller type detailing the comparative anatomy—such are the temptations to read more deeply.

This quality has been maintained in the later volumes. The second is devoted to clinical methods of examination, congenital and developmental anomalies, general pathological and therapeutic considerations and diseases of the

outer eye. Diseases of the inner eye form the subject of the third volume. New editions of all three volumes are in contemplation and are certain to be welcomed by all who can read English.

The present volume opens with a section of about four hundred pages devoted to the neurology of vision, commencing at the chiasmal pathway and passing on through the basal visual and intracerebral pathways to a detailed consideration of the higher centres and of the mechanism of perceptual and psychogenic visual failure. The author says that

to a large extent this is the territory of the neurologists—many of whom have turned surgeon—but the interest of the ophthalmologist in the intracranial visual pathways and centres is equally profound. Since in many cases the first and most obvious symptom characterizing these diseases is a failure in vision, the primary diagnosis frequently falls to him with all the responsibility which this entails both with respect to the sight and the life of his patient.

These words from the introductory paragraph are followed by a brilliant essay surveying the whole pathway with a breadth and depth of outlook which is quite phenomenal. Opening this section at random, the reader is led to trace, with ever deepening interest, the relations of the particular topic. Back and forward the account swings, with a reference to the earlier volumes here and a footnote to the projected volumes there. However abstruse the subject-matter may be, Duke-Elder never allows it to get out of control, and a homely simile or a well-chosen phrase makes us realize that he appreciates this need. Each sub-section terminates with references to the literature of the world in which the outstanding monographs, the key papers and the minor contributions are all listed.

The middle portion deals with the motor anomalies of the eye, commencing with a historical introduction, consideration of anomalies of movement, binocular fixation, concomitant squint, noncomitant squint, ocular deviations and pathological nystagmus. The final part is concerned with errors of refraction, anomalies of accommodation, aniseikonia, eye-strain and visual hygiene, spectacles and other optical appliances. A brief catalogue of contents such as this does scant justice to the delightful quality of the writing throughout, which has been sustained in all the volumes along with meticulous proof-reading. There are over five thousand references to the literature in this volume alone and the last illustration is fig. 3985. The whole book is encyclopaedic without pedantry and no other branch of medicine possesses anything comparable.

<sup>1</sup> *Text-book of ophthalmology. Vol. IV. The neurology of vision. For particulars, see p. 274.*

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## 1459 The Essentials of Modern Surgery

Edited by R. M. Handfield-Jones & A. E. Porritt. Third edition. Edinburgh: E. & S. Livingstone Ltd., 1948. xix + 1,256 pages; 644 illustrations. 25 × 16 cm. £2 10s. [£2.5]

(i) Inflammation and repair; (ii) infection and immunity; (iii) non-specific infections; (iv) specific infections; (v) venereal diseases; (vi) tumours and cysts; (vii) wounds and burns; (viii) haemorrhage and shock; (ix) ulceration and gangrene; (x) general surgical technique; (xi) chemotherapy; (xii) physiotherapy and radiotherapy; (xiii) diseases of the skin; (xiv) infections of the fingers and hand; (xv) the surgery of the blood vessels; (xvi) the diseases of the lymphatic system; (xvii) the face, lips and jaws; (xviii) the mouth, palate, tongue and salivary glands; (xix) the surgery of the neck; (xx) the ear; (xxi) affections of the nose and accessory sinuses; (xxii) the pharynx and oesophagus;

(xxiii) the larynx; (xxiv) the chest; (xxv) the breast; (xxvi) the general surgery of the abdomen and peritoneum; (xxvii) hernia; (xxviii) the stomach and duodenum; (xxix) the small and large intestine; (xxx) intestinal obstruction; (xxxi) the rectum and anal canal; (xxxii) the diseases of the appendix; (xxxiii) the liver and biliary system; (xxxiv) the pancreas and the spleen; (xxxv) the kidney and ureter; (xxxvi) the bladder, prostate and vesicles; (xxxvii) the penis and urethra; (xxxviii) the testis and spermatic cord; (xxxix) diseases of the female genital organs; (xl) diseases of the scalp and skull; (xli) the brain and its coverings; (xlii) diseases of the spine and spinal cord; (xliii) injuries and diseases of the nerves; (xliv) injuries of bones and joints; (xlv) injuries of the upper limb; (xlvi) injuries of the lower limb and of the spine; (xlvii) diseases of bone; (xlviii) diseases of joints; (xlix) deformities; (l) diseases of the muscles, tendon sheaths and bursae; (li) amputations. Index.

There are several impressive features in this new edition of *The essentials of modern surgery*, edited by R. M. Handfield-Jones &

A. E. Porritt. The first is the excellence of the production, as regards binding, paper and general arrangement. The second is the great care taken by the editors with their illustrations, x-ray plates, and of which are in colour. As a high light, six x-ray plates by Anna Zinkeisen are included.

The subject-matter is attractively treated and the whole field of general surgery is covered, without the superfluity of operative details and obsolete theory which appears in many textbooks of surgery. Certainly Mr. Handfield-Jones and Mr. Porritt have produced a book which is easy to read—an unusual feature—but which presents to the practitioner and to the postgraduate working for a higher degree all the information they require. Chapters on chemotherapy and amputations have been included in this edition, at the expense of the chapter on anaesthesia. The section on the cleft palate has been rewritten. All the other chapters have been brought up to date—a most important feature, since chemotherapy now exerts a profound influence on surgical procedure. At the end of several chapters an operative appendix has been added and is most valuable.

The editors have wisely called in their colleagues to write certain of the chapters, and that on diseases of the chest, revised by Tudor Edwards shortly before his death, deserves special mention. Chapters by E. P. Broekman on diseases of bones and joints; Lionel Colledge on diseases of the ear, pharynx, etc.; Walter Mercier on deformities, and Dickson Wright on diseases of the brain and diseases of the scalp and skull, are noteworthy.

There is no doubt that this book will remain the favourite with the majority of students preparing for a qualifying examination in surgery. Both the editors are distinguished teachers and experienced examiners and know what the student wants. Furthermore the general practitioner and the postgraduate taking a higher examination will find it provides a complete survey of modern surgical opinion. It is a book that can be recommended unreservedly.

R. T. Campbell

#### 1460 Minor Surgery

Edited by Heneage Ogilvie & William A. R. Thomson. Second edition. London: Eyre & Spottiswoode Ltd., 1949. (The Practitioner Handbooks.) xiv + 192 pages; 34 figures. 22 x 14 cm. 14s. [£0.7]

(i) Minor wounds; (ii) burns of slight degree; (iii) sprains; (iv) bursae and ganglia; (v) some benign tumours and cysts; (vi) varicose veins, ulcers and phlebitis; (vii) the hand; (viii) the foot; (ix) the mouth; (x) the nose and throat; (xi) the ear; (xii) the eye; (xiii) the rectum; (xiv) the genito-urinary system; (xv) gynaecology; (xvi) the non-operative treatment of hernia: trusses and belts; (xvii) childhood; (xviii) anaesthesia and analgesia; (xix) chemotherapy. Index.

This book consists of a series of short articles on minor surgical procedures, compiled by men who are authorities in their subjects. As such, it is an eminently readable volume, but is not well illustrated. The chapter on the hand, by Norman C. Lake, is especially good, the anatomical and scientific bases of treatment being clearly pointed out. The chapters on the rectum, by W. B. Gabriel, the genito-urinary system, by Clifford Morson, and gynaecology, by Douglas MacLeod, are also noteworthy. The chapter dealing with children is worth while, and the inclusion of a short article on trusses and belts is unusual but extremely useful.

There are some points which will not pass unchallenged. It is much safer, in rendering the field bloodless for operations on the arm, to use an inflatable cuff rather than the Esmarch bandage recommended by Wakeley. Two weeks in bed after varicose-vein operations is neither practical nor necessary. The importance of a large fluid intake during sulphonamide therapy is not pointed out and is of special importance with out-patients. Still, this book abounds in practical tips and will be useful to the newly-qualified man holding a post as casualty officer, and to the general practitioner-surgeon.

R. T. Campbell

#### 1461 Handbook of Surgery

Eric C. Mekie & Ian Mackenzie. Second edition. Edinburgh: E. & S. Livingstone Ltd., 1949. xvi + 764 pages; 29 figures. 19 x 13 cm. £1

(i) Inflammation; (ii) specific infections; (iii) the general effects of injury; (iv) wounds: burns and scalds; (v) ulceration and gangrene; (vi) tumours; (vii) lesions of the skin; (viii) surgery of the vascular system; (ix) lymphatic system; (x) autonomic nervous system; (xi) lesions of the head, skull and brain;

(xii) lesions of the mouth and salivary glands; (xiii) neck, thyroid, thymus; (xiv) lesions of the oesophagus; (xv) thorax; (xvi) breast; (xvii) spine and spinal cord; (xviii) abdomen; (xix) the abdominal wall and hernia; (xx) peritoneum; (xxi) lesions of the stomach; (xxii) the intestines; (xxiii) the appendix; (xxiv) rectum and anus; (xxv) gall-bladder, liver and pancreas; (xxvi) the spleen; (xxvii) the kidney; (xxviii) lesions of the bladder, prostate and urethra; (xxix) lesions of the testicle, penis and scrotum; (xxx) lesions of bone; (xxxi) diseases of the joints; (xxxii) muscle, tendon and fascia; (xxxiii) peripheral nerves; (xxxiv) lesions about the shoulder and of the arm; (xxxv) lesions about the elbow; (xxxvi) lesions of the forearm and about the wrist; (xxxvii) lesions of the hand; (xxxviii) surgery of the hip and thigh; (xxxix) surgery of the knee; (xl) surgery of the leg and ankle; (xli) the foot. Index.

This book should serve a very useful purpose not only for the undergraduate but perhaps even more for the postgraduate student. The main surgical topics are dealt with systematically, briefly and concisely, yet without sacrificing any essential details. However, the sections on treatment are inadequate for anyone above the undergraduate level; as one might expect, there is no reference to operative technique, and for any details of treatment reference must be made to larger volumes. Nevertheless, a great deal of useful material has been compressed into 750 small pages, and some detail is given which one often fails to find in larger volumes.

The book covers the whole field of surgery, including orthopaedic and traumatic surgery; the pathological and anatomical aspects are dealt with briefly, but at sufficient length to be of value to the non-specialist. The few diagrams are clear and helpful: in future editions these might even be increased in number at the expense of increasing the size and price of the book.

L. Eckert

#### 1462 Illustrations of Surgical Treatment. Instruments and Appliances

Eric L. Farquharson. Third edition. Edinburgh: E. & S. Livingstone Ltd., 1949. xii + 391 pages; 61 plates; 319 figures. 25 x 16 cm. £1 5s. [£1.25]

Part I. Infusion and transfusion. (i) Intra-venous saline infusion; (ii) transfusion of blood and protein fluids. Part II. Vertebral column and ribs. (iii) Fractures and dislocations of the spine; (iv) tuberculosis of the spine (Pott's disease); (v) fractures of the ribs. Part III. Shoulder girdle and upper extremity. (vi) Injuries of the clavicle; (vii) dislocation and fracture dislocation of the shoulder; (viii) fractures of the humerus; (ix) the elbow region; (x) fractures of the forearm; (xi) injuries about the wrist; (xii) injuries of the hand and fingers. Part IV. Pelvic girdle and lower extremity. (xiii) Fractures of the pelvis; (xiv) the hip joint; (xv) fractures of the neck of the femur; (xvi) fractures of the shaft of the femur; (xvii) the knee joint; (xviii) fractures of the lower leg; (xix) injuries to the ankle joint; (xx) fractures of the calcaneum; (xxi) deformities of the foot. Appendix: instruments and appliances. Index.

The fact that this book has run into its 3rd edition since first published in 1939 must indicate a healthy appetite for instruction in surgical technique. Part I deals in a clear and detailed manner with intravenous infusion and transfusion techniques. Perhaps the importance of the rhesus factor outside obstetric circles is understated. In civil practice blood demands can usually be assessed far enough ahead to allow of full compatibility tests.

Part II is confined to the treatment of conditions affecting the locomotor system. In the space available only a very limited selection has been possible and it cannot therefore be in any way considered as a work of reference. In the main, where alternative methods of treatment are available all are described—the author showing obvious preference for particular methods. In the treatment of minor compression fractures of the lumbodorsal region of the spine it is surprising to find that active exercises, without recourse to splintage, find no place. It will amaze many orthopaedic surgeons to be told that it is necessary to remove a Thomas frame daily in order to perform skin toilet.

Excision of the outer end of the clavicle is not considered for unreduced acromioclavicular dislocations. The essential difference between the impacted and unimpacted fractures of the surgical neck of the humerus is neglected. Fractures of the metacarpals are apparently splinted even if no displacement is present.

In the description of the Watson-Jones' "lateral recumbency" method of treating fractures of the pelvis, the substitution of "affected" for "unaffected" shows careless reading of the original article.

The air of easy optimism assumed towards congenital dislocation of the hip is remarkable. Three attempts at manipulative reduction are allowed before the knife can be wielded; no attempt to assess the cause of failure by arthrography is advised. Apart from the Putti mattress which is reserved for infants, the frog plaster is recommended for all cases. As illustrated, this is a cumbersome affair extending from nipples to toes. The work of Leveuf, Batchelor and Denis Browne is, apparently, unknown.



Part III is an expurgated edition of the instrument maker's catalogue. The prize goes to Plate XX illustrating tourniquets which can only have come from the torture chamber or the museum at Surgeons' Hall.

All in all, this is a book which might profitably fill an idle half-hour, but cannot be recommended for serious study.

Guy Rigby-Jones

## 1463 The Surgery of Abdominal Hernia

George B. Moir. London: Edward Arnold & Co., 1948. 408 pages; 138 figures. 22 x 14 cm. £1 5s. [£1.25]

(i) General observations concerning abdominal herniae; (ii) the management and treatment of strangulated and obstructed hernia; (iii) anaesthesia; (iv) economic and legal significance of herniae; (v) anatomy of the inguinal canal; (vi) function of the inguinal canal and its associated structures; (vii) structure and classification of inguinal herniae; (viii) aetiology of inguinal herniae; (ix) clinical picture, diagnosis, and complications of inguinal herniae; (x) pathological and anatomical changes within the inguinal canal in consequence of inguinal hernia; (xi) rationale of treatment in inguinal hernia. Criteria for operation; (xii) cutis and whole skin graft repair; (xiii) operative technique in inguinal herniae; (xiv) femoral hernia; (xv) umbilical hernia; (xvi) ventral hernia; (xvii) obturator hernia; (xviii) sciatic hernia; (xix) internal hernia; (xx) lumbar hernia; (xxi) sliding hernia. Extrasaccular hernia; (xxii) hernia of the vermiform appendix; (xxiii) Richter's and Littre's hernia; (xxiv) hernia of the uterus and adnexae; (xxv) diaphragmatic hernia. Index.

In this book most of the modern views on all varieties of abdominal herniae are quoted and soundly discussed. The early chapters on such topics as anatomy, etiology, general management, and legal aspects are precise, detailed, and clearly presented. There follows a good description of each variety of hernia, together with any special features, complications, and particular points in operative repair. At the end of every chapter is a carefully selected bibliography which would provide a solid basis for those interested in a detailed study. On all topics, including operative treatment, the author has endeavoured to present both sides of controversial matters, but he rightly gives his own opinion as a guide to the less experienced in practical matters.

The sections on operative treatment are clearly described, and special techniques well illustrated. It is natural that a full description should be included of the author's own method of repair by whole skin grafts, but too much emphasis is given to a technique which still awaits the test of time. Eighteen pages are devoted solely to photomicrographs of histological sections of skin grafts, and here the book is, perhaps, a little unbalanced. After a survey of the evidence, the author condemns the Bassini type of repair, and although he finds the local result to be favourable in fascial darts, he objects to the short available strips in McArthur's operation and to the damage to the thigh in the Gallie repair. Other modern techniques such as darning with nylon, or steel wire, or the use of a sheet of polythene were too recently announced to find a place, but in general the author does not favour repair by unabsorbable materials.

On the question of postoperative rising, there are many these days who would side with the Air Force surgeon whom the author quotes as saying he "was all for getting cracking a day or two after operation." If it is necessary, as the author advises, for the patient to stay in bed for three weeks after the operation, his repair is not an attractive one by economic standards. Surely it is just as safe to let the patient rise as soon as possible, and so exercise his abdominal muscles, as to let him lie abed and endeavour to exercise his legs at the command of a zealous young woman.

On the whole it is a thoughtful, well-presented survey, and will be much appreciated by students and surgeons.

G. E. Moloney

## 1464 Genito-Urinary Surgery

John Thomson-Walker. Third edition, edited and revised by Kenneth Walker. London: Cassell & Co. Ltd., 1948. xviii + 956 pages; 282 figures; 58 plates. 24 x 16 cm. £3 10s. [£3.5]

(i) The kidney; (ii) the ureter; (iii) the bladder; (iv) the urethra; (v) the prostate; (vi) the seminal vesicles and Cowper's glands; (vii) the testicle; (viii) the tunica vaginalis; (ix) the spermatic cord; (x) the scrotum; (xi) the penis. Index.

The appearance of a 3rd edition of Thomson-Walker's *Genito-urinary surgery* will be a source of pleasure to urologists in this country. The 1st edition appeared in 1914, when urology was in its infancy. Much has happened since then—the perfection of a

wide variety of urological instruments; the introduction of intra-venous pyelography; the various methods of treating prostatic enlargement; ureteric transplantation; and the employment of sulpha drugs, penicillin and streptomycin in genito-urinary infections.

Mr. Kenneth Walker has been careful to preserve the personality and character of the original work and at the same time to bring it up to date. The illustrations, particularly the colour plates, are very good, and the English is clear and concise. There is a welcome chapter on male sterility, a branch of urology in which Mr. Kenneth Walker has been prominent, and which has been up till now grossly neglected. The chapter on the prostate is particularly good and the many operative procedures, including Millin's retropubic approach, are well described. Emphasis is laid on the fact that none of these procedures is the best or the only one: a surgeon must adapt the operation to the patient and to the type of prostatic obstruction which is present.

In the chapter on cancer of the bladder there is a welcome description by Mr. Anthony Green on radiation in bladder growths, and the necessity of team work between the urologist and the radiotherapist is emphasized. A fuller description of total cystectomy would enhance the value of this chapter. There is some confusion on the question of tuberculous bacilluria and not sufficient stress is laid on the fact that the primary renal lesion is bilateral in most cases. There is no mention of Medlar's work and no reference to transplantation of the ureter to relieve the "cystitis dolorosa" of the small tuberculous bladder. As to where to transplant the right ureter, most urologists would prefer the pelvic colon rather than the caecum or ascending colon: caecal transplantations are notoriously liable to break down.

It is to be regretted that separate chapters have not been allotted to urological problems in children and in women, and that no mention is made of such well-known procedures as Fey's operation for nephrectomy, Wilson Hey's technique of prostatectomy and McIndoe's operations for hypospadias and epispadias. Another criticism is that the lists of references are in several cases out of date and a false impression of the modern nature of the work may be created as a result of this. Although the text abounds in quotations from recent publications, it would be of distinct value, where no mention is made of these in the bibliographies, if the date of the publication were inserted in brackets after the author's name.

This is a sound British textbook, which can be heartily recommended as a work of reference for students and general surgeons, and as a faithful stand-by for urological specialists.

J. H. Carver

## 1465 Recent Advances in Oto-Laryngology

R. Scott Stevenson. Second edition. London: J. & A. Churchill Ltd., 1949. vii + 395 pages; 8 plates; 106 text-figures. 21 x 14 cm. £1 4s. [£1.2]

(i) Chemotherapy and antibiotics in oto-laryngology; (ii) hearing tests; (iii) hearing-aids; (iv) theories of hearing; (v) otosclerosis; (vi) the mechanism of the labyrinth; (vii) Ménière's disease; (viii) the conservative treatment of chronic middle-ear suppuration; (ix) the surgical treatment of facial paralysis; (x) aviation oto-laryngology; (xi) radiological examination of the nasal accessory sinuses; (xii) nasal sinusitis and its treatment; (xiii) malignant disease of the nasal sinuses; (xiv) tonsils and adenoids; (xv) malignant disease of the pharynx; (xvi) the mechanism of the larynx; (xvii) cancer of the larynx; (xviii) tuberculosis of the larynx; (xix) bronchoscopy and oesophagoscopy; (xx) cancer of the oesophagus. Index.

As the name of this book implies, it has been written with the object of mustering together new facts which have made their appearance in the otorhinolaryngological field in recent years and, as such, is a monumental review of the literature on the subject, all the more remarkable because it has been the work of a single author.

Fourteen years have passed since the 1st edition of this deservedly popular book, and in its present edition the text has been rewritten and enlarged, three new chapters taking the place of five which have been discarded. So numerous and so rapid have been the advances that little of the old text remains, and the 2nd edition is in reality a new book.

The publishers are to be congratulated on the way in which they have prepared this book. The general standard of the production is high, and binding, typography, and lay-out are excellent. The eight plates and the 106 text-figures have been carefully reproduced.

The 20 chapter titles are well chosen on the whole, and the text comprises some 387 pages in all. A notable feature of the book

is the excellent bibliography at the end of each chapter, and the ample references should prove a great help to future readers. The author first abstracts his subject-matter for a given chapter and then presents the differing views in a correlated manner which is easy to read. Finally, to help the reader still further, he crystallizes the whole chapter in a well-written conclusion which embodies his own opinion on the subject-matter which has been presented.

To pick out portions of the text for individual notice is difficult as the standard throughout is excellent. One would like to mention, however, certain chapters which are outstanding. In particular, the first chapter, which gives a general review of chemotherapy and the antibiotics in clinical practice, is a masterly review of our present knowledge. The danger of "masking" symptoms and signs is rightly stressed, and the necessity for surgical intervention when it is called for is emphasized.

The subject of audiology (hearing tests and hearing aids) is well presented. The surgical treatment of otosclerosis is dealt with in one of the best chapters, and aviation otolaryngology in another.

No mention is made of the important subject of blast deafness, and the recruitment phenomenon is also missed out. The text would have been improved by their inclusion. The chapter on tonsils and adenoids could have been omitted entirely without detracting from the value of the book as it contains little that is new, whilst the very beautiful pictures of tonsillectomy by dissection belong to a textbook proper rather than to a book of this nature.

This book is one which should be read by all interested in the specialty, for all will gain much from a perusal of its pages.

F. Boyes Korkis

#### 1466 Diseases of the Nose and Throat. A Textbook for Students and Practitioners

St. Clair Thomson & V. E. Negus. Fifth edition. London: Cassell & Co. Ltd., 1948. xix + 1,004 pages; 44 plates; 369 figures. 24 x 16 cm. £3 10s. [£3.5]

(i) Introductory; (ii) diseases of the nose; (iii) diseases of the accessory sinuses (paranasal sinus diseases); (iv) tumours of the nose and accessory sinuses; (v) diseases of the naso-pharynx; (vi) diseases of the pharynx and tonsils; (vii) diseases of the larynx; (viii) diseases of the trachea and bronchi; (ix) diseases of the oesophagus; (x) foreign bodies. Peroral endoscopy; (xi) chronic infective diseases; (xii) acute specific fevers in the nose and throat; (xiii) the nose and throat in some general affections. Formulæ. Index.

A period of 12 years has intervened since the appearance of the 4th edition of this excellent textbook. The present edition retains the spirit of the original work, and Mr. Negus has succeeded in the task of incorporating the many advances made in this field; a task made the more arduous because of the impact of chemotherapy and the many changes it has brought. The reviewer of such a book need hardly criticize: he can only indulge in the pleasure of praise. It is sufficiently comprehensive to more than satisfy the needs of the student, and the specialist reader will profit from the scholarly and balanced views on diagnosis and treatment which are presented in great detail.

In a short review it is difficult to give an adequate impression of the scope of the work. The 13 sections cover the field with admirable completeness. A full section is devoted to diseases of the accessory nasal sinuses, in which the various operative procedures are described and their attendant dangers discussed. For rhinodacryocystostomy West's operation is preferred to that of Dupuy-Dutemps, a view which is not held by all. A further section deals with growths of the nose and sinuses; in this, a combination of deep x rays and surgery (using diathermy) is advocated for the treatment of growths of the antrum and ethmoid. Removal of the hard palate is advised to permit thorough inspection of the cavity. The preference for this method is adequately supported by the statistics given. It is suggested that the growth may originate in or involve the frontal sinus; the great rarity of this might have been mentioned.

Present-day views on the question of the removal of tonsils and adenoids are fully discussed; this part of the book is most valuable. The operative techniques are again fully described; the La Force instrument for the removal of adenoids is preferred as doing less damage to the mucous membrane. The differential diagnoses of tonsillar infections are given fully. Other sections, especially that dealing with diseases of the trachea and bronchi, reflect the wide personal experience of the author.

This book is a *sine qua non* of every library dealing with otolaryngology; there are few who will not benefit from its perusal. There are full lists of references at the end of every chapter, and its value is further enhanced by profuse illustrations, including 13 excellent colour plates.

W. M. M.

#### 1467 A History of Oto-Laryngology

R. Scott Stevenson & Douglas Guthrie. Edinburgh: E. & S. Livingstone Ltd., 1949. vii + 155 pages; 52 figures. 22 x 14 cm. 17s. 6d. [£0.875]

(i) Introduction; (ii) ancient history; (iii) the Middle Ages and the Renaissance; (iv) the seventeenth and eighteenth centuries; (v) otology becomes science; (vi) the education of the deaf; (vii) laryngology in the nineteenth century; (viii) modern history. Bibliography. Index.

This small book which numbers only 137 pages of text is the first history of otolaryngology to be published. However, several different authors have previously published books dealing with the history of one or other branch of the specialty. Politzer has written a history of otology and Chauveau a history of pharyngeal diseases; these detailed studies have been consulted in the preparation of the present volume which is a short account of the rise of the specialty from the writings found in the Egyptian papyri, through the Middle Ages to modern times. To have packed so much history in so small a space is a fine achievement in concise writing but there are omissions which are inevitable in a book of this type. The authors have presented their subject-matter in a very readable manner, and, having read this book, one was left with the feeling that one wished that there had been much more of it. It is of ideal size to slip into the pocket for odd-moment reading, and it makes an excellent bedside companion.

The text is illustrated with 52 figures; among them there are some excellent reproductions of portraits of eminent historical persons, whilst others depict operations and instruments. The publishers are to be congratulated on the high quality of the reproductions throughout the book. The lengthy bibliography at the end of the book will be of help to those who wish to undertake further reading. Herein one finds listed the names of over 200 authors, containing even more references to their different publications. This book should appeal to a wider public than the ear, nose and throat specialist, and, in fact, every practitioner will find something to interest him and much to enjoy.

F. Boyes Korkis

#### 1468 A Handbook of Ophthalmology

Humphrey Neame & F. A. Williamson-Noble. Sixth edition. London: J. & A. Churchill Ltd., 1948. x + 336 pages; 189 figures. 24 x 15 cm. £1 1s. [£1.05]

(i) Examination of the eye and its accessories; (ii) action and accommodation; (iii) eyelids and lacrimal apparatus; (iv) of the eyeball; (v) the conjunctiva; (vi) cornea and sclera; (vii) body and choroid; (viii) the lens; (ix) the vitreous; (x) the retina; (xi) the optic nerve; (xii) glaucoma; (xiii) extrinsic muscles; (xiv) orbit; (xv) operations; (xvi) ophthalmological signs and symptoms in general diseases; (xvii) eye diseases in the tropics; (xviii) therapeutics. Appendix: services. Glossary. Index.

This is one of the shorter textbooks of ophthalmology, intended for the student and general practitioner; the fact that since 1942 a new edition (or reprint) has been called for every two years shows its popularity. The book is a concise and up-to-date presentation of the accepted teachings. The planning of the chapters is in line with the modern classification—congenital, traumatic, inflammatory, and neoplastic—except where such classification is inapplicable. The methods of examination and refraction occupy 64 pages. Instead of a selection of methods, only one is given and adequately described which, if followed, should satisfy most needs. The localization of the depth of a corneal lesion by means of focal illumination and parallax (without slit lamp) is too much to expect from a student. The duochrome test is used in association with the cross cylinder and it is emphasized that without checking and rechecking with the duochrome test it is easy to fall into the trap of misjudging the cylinder component with the cross cylinder. This is a point not appreciated sufficiently by many advanced students. For conjunctivitis the sulphonamide and penicillin treatments are well presented. In iritis the allergic factor is mentioned. The descriptions of the operations are clear and easy to follow. The illustrations are a notable feature of the book.

M. Klein

## 1469 Diseases of the Eye. A Textbook for Students and Practitioners

Eugene Wolff. Third edition. London: Cassell & Co. Ltd., 1948. x + 208 pages; 133 text illustrations; 5 colour plates. 25 x 19 cm. £1 1s. [£1.05]

(i) Diseases of the conjunctiva; (ii) diseases of the cornea; (iii) diseases of the eyelids; (iv) diseases of the iris and ciliary body; (v) ophthalmoscopy; (vi) diseases of the lens; (vii) glaucoma; (viii) diseases of the retina; (ix) diseases of the choroid; (x) diseases of the vitreous; (xi) diseases of the sclera; (xii) injuries of the eye; (xiii) congenital anomalies; (xiv) diseases of the optic nerve; (xv) diseases of the orbit; (xvi) diseases of the lacrimal apparatus; (xvii) the pupil; (xviii) the field of vision; (xix) strabismus or squint; (xx) nystagmus; (xxi) errors of refraction; (xxii) intra-ocular new growths; (xxiii) eye complications of some general diseases; (xxiv) operations; (xxv) bandaging, and medicinal applications. Index.

The 3rd edition of this book, like its predecessors, is written primarily for the student and general practitioner and with obvious sympathy for the examinee. The symptoms, signs, complications, sequelae and treatment of the common diseases and of injuries of the eye and orbit are dealt with in considerable detail, while short sections are devoted to the less common symptomatic conditions so that there is little, even among the rarer forms of eye disease, which does not receive at least some mention. There are separate chapters on congenital anomalies and on intraocular new growths. The theory and treatment of concomitant squint and of refractive errors are concisely explained. Surgical methods are described in some instances in their appropriate context but there is a separate chapter on the common ophthalmic operations and another on bandaging and nursing methods.

Perhaps the most valuable aspect of the book is the attention given to the medical side of ophthalmology in the short but excellent chapters on ophthalmoscopy, diseases of the retina and of the optic nerve, anomalies of the pupil, visual fields, squint and the eye complications of general diseases.

In criticism, the arrangement of the chapters is disconcertingly disconnected, though doubtless this is done with a purpose. A chapter on the differential diagnosis of common symptoms and signs would be helpful to the public for which the book is designed. Lastly one wonders how far the practitioner is expected to go with his treatment; for instance, in the treatment of burns so much can be done nowadays by the expert in the early stages to minimize the seriousness of the sequelae that one feels that early reference of these cases, and of others, to a specialist should be emphasized.

The illustrations are good, particularly the beautiful anatomical drawings from the author's *Anatomy of the eye and orbit*. There is a comprehensive index and the work is to be recommended as an attractive and practical handbook.

A. Lister

## 1470 Das Haftglas als optisches Instrument. Eine vergleichende Darstellung der optischen Wirkungsweise von Kontaktglas und gewöhnlicher Brille

E. Bürki. Basle: S. Karger, 1948. vi + 322 pages; 81 illustrations. 25 x 17 cm. 55 Sw. fr.

Einleitung. Vorbemerkungen zur allgemeinen Dioptrik. Das Auge und das Haftglas. A. Theoretischer Teil. B. Praktischer Teil. Anhang: die Heineschen afokalen Haftgläser. Literatur. Tabellenverzeichnis. Sachverzeichnis. Namenverzeichnis. Abbildungsstil.

Contact lenses have passed the experimental stage and have secured a permanent place in ophthalmic practice. They were first used on the Continent but for the last 15 years most developments have come from work in Great Britain and in the USA. Bürki's is the first substantial book outside the English-speaking world, and is a welcome addition to the existing literature. The book is well produced; paper, type and print are good. It deals comprehensively with the optics of contact lenses on the basis of Gullstrand's dioptric concept. A general introduction on optics is followed by a discussion of the special problems of the contact lens and the eye, and these are contrasted with the optical principles involved in lens at some distance in front of the eye. This parallel presentation facilitates the understanding of the differences between spectacles and contact lenses. Graphs and tables relating to the cardinal points, magnification, size of retinal image etc., are the result of long hours of patient work. The mathematics are fairly simple and numerical examples are worked out at the end of each chapter.

Only a relatively small part of the book is devoted to practical questions. The specification of the trial sets of different firms are

given. In the part dealing with the fitting, the statement that the trial contact lens with optical power ground on it should be of higher power than the spectacle correction in hypermetropes, and weaker in myopes, is too dogmatic, and neglects the relation of the inside curve of the contact lens to the radius of curvature of the cornea. In the instructions on how to insert and remove a contact lens illustrations would have been useful. In the procedure of fitting, the author does not mention his personal experience. The statement that with fenestrated types of contact lenses no veiling occurs hardly agrees with the experience of many surgeons. However, these are minor criticisms, and the book can be recommended. In a future edition the theoretical parts might be balanced by more practical details.

M. Klein

## 1471 Anaesthesia for the Poor Risk, and Other Essays

William W. Mushin. Oxford: Blackwell Scientific Publications, 1948. ix + 65 pages. 22 x 14 cm. 7s. 6d. [£0.375]

(i) The poor risk patient; (ii) convulsions during anaesthesia; (iii) haemorrhage and anaesthetic dosage; (iv) anaesthesia for thoracoplasty; (v) ether impurities; (vi) the hazards of pentothal; (vii) the ether war; (viii) refrigeration anaesthesia; (ix) synthetic substitutes for morphia; (x) analgesia in obstetrics; (xi) the efficacy of oily solutions of local anaesthetics; (xii) morbidity versus mortality; (xiii) anaesthesia by hypnosis; (xiv) some analgesics compared; (xv) record cards for the anaesthetist; (xvi) continuous caudal analgesia in obstetrics; (xvii) reviving the "dead"; (xviii) curare; (xix) delayed morphine poisoning in casualties; (xx) the wrong cylinder; (xxi) post-operative chest; (xxii) anaesthetics in the Pacific war zone; (xxiii) concerning relaxation in abdominal surgery; (xxiv) continuous spinal analgesia; (xxv) regional anaesthesia; (xxvi) the "safety" of nitrous oxide; (xxvii) what, no curare?; (xxviii) mechanical respirators.

This small book deals with many aspects of anaesthesia. The author's ideas are graphically told in 28 essays, many of them masterpieces of clear thinking; and they possess the charm of being written in good, simple English. There is much sound advice for the anaesthetist, the outcome, no doubt, of the author's long experience at Oxford. He has chosen an unusually wide range of subjects—as examples may be mentioned hypnosis, continuous spinal anaesthesia, the effect of peroxides in ether on induction time, and substitutes for morphia.

Although one essay only concerns anaesthesia for the poor risk patient, the administration of anaesthetics to shocked cases is seldom far from the author's mind and recurs again and again in his essays. His knowledge as a practising anaesthetist is constantly in evidence: he points out, for instance, the wisdom of washing out the stomach when faecal vomiting is present, and stresses the danger of spinal anaesthesia in shock; it is a satisfactory anaesthetic only for the good risk patient. To the little experienced he says "Give what you are used to" and "In the shocked patient it is the amount and the skill of administration rather than the drug which counts." It may, however, be said that some drugs are more toxic than others and put greater strain on the patient in eliminating them. He is a great ether protagonist, and there are many who will agree with him.

Speaking of the newer anaesthetics his remark, "Morbidity may no longer shadow the patient in the ward, but mortality is at his side in the operating theatre," is one whose truth cannot be denied. One must, however, believe that the author's experience of the young anaesthetist has been unfortunate, for when discussing the use of endotracheal tubes in abdominal surgery, he declares "... some of the patients will pay the price in terms of laryngeal trauma and infection." In an abdominal operation the anaesthetist often has so many duties, such as attending to transfusions, giving additional injections, taking blood pressure readings, that, unless he has an assistant, a perfect airway may be maintained throughout the operation only by the use of an endotracheal tube, and this method has certainly been used in many thousands of cases without mishap. In order to prevent postoperative respiratory complications the author suggests putting the patient into an iron lung; this novel plan may be good for the occasional case, but is hardly practicable in a busy hospital; and it is possible that more activity of the limbs than is obtainable in the iron lung may sometimes be desirable if thrombotic complications are to be avoided.

The essays make easy reading, and they are well worth while, for they are the product of an exceptionally active mind; moreover they contain food for thought, not only for the young, but also for the experienced, anaesthetist. The book looks well, and Blackwell Scientific Publications could be congratulated on their work were it not for the fact that the binding has a tendency to come unstuck.

S. Rowbotham

## 1472 Recent Advances in Anaesthesia and Analgesia (Including Oxygen Therapy)

C. Langton Hewer. Sixth edition. London: J. & A. Churchill Ltd., 1948. viii + 380 pages; 149 figures. 21 × 14 cm. £1 1s. [£1.05]

(i) Theoretical aspects of inhalational anaesthesia; (ii) premedication; (iii) nitrous oxide and the hydrocarbon gases; (iv) carbon dioxide and helium; (v)

aspects of local analgesia; (xiii) drugs used in local analgesia; (xiv) recent advances in the technique of local analgesia; (xv) the present position of spinal analgesia; (xvi) collapse and resuscitation; (xvii) anaesthesia and analgesia for neuro-surgery; (xviii) anaesthesia and analgesia for dental surgery; (xix) anaesthesia and analgesia for endoscopy, for nasal, oral and maxillo-facial surgery, and for operations upon the pharynx and larynx. Use of suction; (xx) anaesthesia and analgesia for thyroid and thymic surgery; (xxi) anaesthesia and analgesia for thoracic surgery; (xxii) anaesthesia and analgesia for abdominal surgery; (xxiii) anaesthesia and analgesia in obstetrics—resuscitation of the new-born; (xxiv) anaesthetic sequelae; (xxv) psychological aspects of anaesthesia and analgesia; (xxvi) oxygen therapy; (xxvii) anaesthetic charts and records. Index.

A new edition of *Recent advances in anaesthesia* is always something of an event. Four years have elapsed between the appearance of this and of the previous edition; and they have been fruitful years. This edition follows the same plan as its predecessors, but it contains much fresh material and many new illustrations.

The outstanding advance during this period has been the introduction and widespread use of curare and other muscle relaxants—a development which has made a profound impression on the science of anaesthesia. This development is justly accorded a chapter to itself—a chapter already somewhat dated by the recent introduction of two new synthetic curarizing agents.

Continuous spinal analgesia is mentioned, and the section on therapeutic spinal block has been enlarged. The controversial subject of choice of anaesthesia for thoracoplasty is fairly dealt with, and the possibilities of extradural spinal block are briefly mentioned. Little change has been made in the chapter on anaesthesia for neurosurgery, and no mention is made of the new technique of obtaining an ischaemic field by controlled preliminary bleeding, and returning the blood to the patient at the end of the operation.

Mention is made of the use of intravenous procaine in the control of cardiac arrhythmias. The dosage of pethidine has been brought up to date, and the new synthetic analgesic "physeptone" is included. "Kemithal" is now given a place among the intravenous barbiturates, and a section on the detoxication of the barbiturates has been added.

The contribution of electroencephalography to our understanding of the mechanism of convulsions associated with anaesthesia is included in this edition. The section on the etiology of pulmonary embolism has been revised and its treatment by the anticoagulants is now included.

Altogether this volume upholds the high tradition of its predecessors. It is well produced, and contains very few errors. (A misprint in the graphic formula of amethocaine on p. 167 is one of these few.) A book which is so widely used for reference deserves a fuller index.

R. Woolmer

## 1473 Cunningham's Manual of Practical Anatomy, Vols. 1, 2 & 3

Revised and edited by James Couper Brash. Eleventh edition. London: Geoffrey Cumberlege, Oxford University Press, 1948. Vol. 1: General introduction. Upper limb, lower limb. xix + 387 pages; 44 plates; 144 figures. 19 × 12 cm. Vol. 2: Thorax and abdomen. x + 488 pages; 24 plates; 212 figures. 19 × 12 cm. Vol. 3: Head and neck; brain. x + 513 pages; 16 plates; 213 figures. 19 × 12 cm. £1 1s. per volume. [£1.05]

Vol. 1: (i) Upper limb; (ii) lower limb. Index. Vol. 2: (i) Thorax; (ii) abdomen; (iii) pelvis. Index. Vol. 3: (i) Head and neck; (ii) organs of hearing and equilibration; (iii) the eye; (iv) the brain. Index.

This well-known work is an excellent companion for the student who is undertaking systematic dissection of the body. Its value is increased by clear illustrations and a number of radiographs of bony structures and vessels injected with radio-opaque material.

The value of such detailed books depends on the amount of time to be devoted to patient and systematic dissection. There is, I

consider, no doubt that the medical student devotes too much time to this occupation in the majority of medical schools. As a result, the undergraduate, while in no sense an anatomist, has acquired temporarily, and only temporarily, an amount of detail far greater than is required for the practice of medicine in most of its branches and indeed far greater than he will be able to retain even should he be a practising surgeon—unless he be one of that small number of surgeons who have succeeded in retaining a sound knowledge of general anatomy while being expert in their chosen field.

For those who are in favour of the present system of patiently disintegrating the body from the scalp to the sole of the foot over a period of between three and five terms, there is no better textbook than this. Moreover, while acquiring much that he will forget, the student will cover the essential points which he is likely to need in subsequent surgical practice. My criticisms are in no sense criticisms of the work as such, which I consider to be an excellent one, but rather of a system which has already served its purpose and is no longer in touch with the needs of medicine as it exists today.

F. S. Gorrill

## 1474 A Synopsis of Regional Anatomy

T. B. Johnston. Sixth edition. London: J. & A. Churchill Ltd., 1948. viii + 436 pages; 17 illustrations. 21 × 14 cm. 18s. [£0.9]

Section I: The upper limb. Section II: The lower limb. Section III: The thorax. Section IV: The abdomen. Section V: The head and neck. Section VI: The central nervous system and organs of special sense. Section VII: Osteology. Index.

The 6th edition of this well-known work, which is such excellent value at 18 shillings, is substantially the same as the 5th edition except that it contains a more detailed account of the extra-pyramidal system. It is a matter for regret that the author has seen fit to increase the number of pages by 13: The general value of this book lies in the fact that it contains those essentials of regional anatomy which can reasonably be expected from the general surgeon or final-year student of surgery. Professor Johnston has shown admirable skill in selecting the essentials and discarding a vast mass of inessential material. When he comes to write the 7th edition, and the demand for the book is such that the time cannot be far distant, I trust that he will, if anything, prune still further the material at his disposal, so that the next edition may be smaller rather than larger.

It is my experience of students taking the Primary Fellowship Examination of the Royal College of Surgeons, that few have succeeded in accumulating a knowledge of regional anatomy more extensive than that comprised within this book. It need scarcely be said that the practising surgeon, outside his own specialty, will usually be found to have an even more scanty knowledge. I feel, therefore, that books larger than this are in general to be discouraged unless they can be looked upon as works of reference to be consulted only on specific occasions. Professor Johnston has emphasized that this book should be used only after the whole of the body has been dissected, but I feel that the earlier the student is introduced to it the better. In this way he may secure a more optimistic view of anatomy and come to the conclusion that it is a finite subject which he may ultimately grasp, instead of a conglomeration of facts, of such magnitude that no average person can hope to retain more than a fraction in his mind at any one time.

F. S. Gorrill

## 1475 Living Anatomy: a Photographic Atlas of Muscles in Action and Surface Contours

R. D. Lockhart. London: Faber & Faber Ltd., 1948. 71 pages; 149 figures. 25 × 16 cm. 12s. 6d. [£0.625]

This book sets out to stimulate the student's interest in the surface anatomy of living subjects. It is presented as a series of 149 well-produced illustrations, the majority of which are concerned with muscles in action. The clarity with which the muscles are demonstrated is a credit to models and photographer alike, as well as to Professor Lockhart, whose knowledge in this field is unrivalled.

The book will be of considerable interest to physiotherapists, orthopaedic surgeons and artists. The general surgeon and the undergraduate student of anatomy will also find material of value here, but they of course are more especially interested in the rela-



tions of the underlying vessels and nerves; these, and the corresponding bony points, find little or no mention in this work. At the end of the book is a small number of illustrations of the breast and eye, but these constitute only a fraction of the whole. It is not easy to see why they should be included while other structures of greater general importance are omitted. The sub-title of this work, *A photographic atlas of muscles in action and surface contours*, makes its content clear whereas the title of *Living anatomy* may perhaps lead to the expectation that the work is more extensive than is actually the case.

F. S. Gorrell

#### 1476 Detailed Atlas of the Head and Neck

Raymond C. Truex & Carl E. Kellner. New York: Oxford University Press; London: Geoffrey Cumberlege, 1948. xiii+162 pages; 136 figures. 31×24 cm. £3 15s. [£3.75]

I. Regional anatomy. (i) Posterior neck and back; (ii) spinal nerve and cutaneous areas; (iii) lateral neck and axilla; (iv) anterior neck and thorax; (v) lateral face, pharynx, and oral cavity; (vi) cranial cavity and contents; (vii) brain: circulation; (viii) brain: topography and dissection; (ix) cerebellum; (x) labyrinth, cavernous sinus, and orbit; (xi) eye and orbital contents; (xii) pharynx and esophagus; (xiii) larynx and trachea; (xiv) nasal cavity and paranasal sinuses; (xv) palatine tonsil and floor of oral cavity. II. Skeletal structures. (xvi) Cervical vertebrae; (xvii) skull; (xviii) ear bones; (xix) median section; (xx) hyoid bone; (xxi) atlanto-axial joint; (xxii) paranasal sinuses. III. Frontal sections. IV. Transverse sections. Index.

In this atlas the majority of the plates are conventional pictures of the anatomy of the head and neck. The authors have not transected the body abruptly at the root of the neck but, where appropriate, have wisely followed structures further, in some cases as far as the diaphragm. Although, as the title implies, a considerable amount of detail is represented, the quality of the illustrations is so good that the detail stands out well and the relative position of different structures can be clearly seen. The blood

supply of the brain is well shown and the attachments of the various cranial nerves can be seen in relation to the blood-vessels. The sections of the central nervous system show the structures which could normally be seen by the naked eye. The gasserian ganglion and its relations are shown from a variety of angles and with the utmost clarity. The orbital contents, the larynx, pharynx and nose are separately illustrated. The paranasal air sinuses receive perhaps less than their share of the authors' efforts.

The pictures of the skull bones are essentially the same as those found in a standard textbook of anatomy though the detail is a little greater and the quality of reproduction higher. The auditory ossicles are generously represented.

Figs. 105 to 136 consist of a series of sections through the head and neck. They are most painstakingly produced and it is clear that considerable labour has been expended on this section. Its value, however, will be limited for most surgeons, and even the majority of anatomists will look askance at some of these figures. Most of us find a section through a limb a puzzling matter and to orientate oneself correctly requires more than momentary effort. In the case of the head and neck, where the basic anatomy is so complex, the section becomes still more an intellectual exercise. I feel that these illustrations might with advantage have been replaced by further pictures of "dissections," comparable with those illustrated, for example, in figs. 9 and 10 (vessels, nerves and muscles of the neck), 21 and 22 (infratemporal region), and 54 and 55 (middle cranial fossa, gasserian ganglion and infratemporal region).

The work is well indexed and excellently produced. There has obviously been the closest co-operation and understanding between the artist and the anatomist. The book will appeal to dental surgeons, otorhinolaryngologists and neurosurgeons. General surgeons with special interest in the thyroid, parotid and other related structures will find much of value in this atlas.

F. S. Gorrell

## OBSTETRICS AND GYNAECOLOGY

1477

### TRAINING AND RECRUITMENT OF MIDWIVES

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University of Manchester

In April 1947 a Working Party was appointed to enquire into the reasons for the shortage of midwives in Great Britain. The Party consisted of two midwives, one woman doctor, one statistician and a lay chairman. Their report<sup>1</sup> has recently been published and has been well received; already the conclusions reached in its many pages have given those of us who are interested in the maternity services much food for thought. The Report is a document of just over 100 pages, in which is given a most comprehensive survey of the present position of midwives in Great Britain. The historical background is reviewed and the attempts to raise the status of the midwife are clearly shown; the relationship—unfortunately not always a happy one—with the medical profession is discussed. The important Midwives Act, 1902, which established the Central Midwives Board, the Midwives Act, 1936,

which placed the responsibility for providing an adequate service of certified midwives on the county or county borough councils, and the National Health Service Act, 1946, which transferred this responsibility to the local health authorities, illustrate the steady growth and improvement in midwifery services. The Working Party remind us that the midwife is a practitioner of normal midwifery and emphasize that she is a practitioner in her own right.

The present shortage of midwives is acute even though in 1937 considerably more of them notified their intention to practise than in 1929. Various factors have contributed to this anomaly. The birth rate has been higher, and antenatal and postnatal care has taken up relatively more of the midwife's time, compelling her to reduce the number of cases under her care.

One of the first difficulties the Working Party met was that the available statistics were often incomplete and sometimes at variance. They were driven, therefore, to make an independent collection of facts; this was done, most successfully, by means of questionnaires. Chapter II of the Report is concerned with the examination of these facts. In Chapter III, "The midwife's place in the health team", the duties of the midwife are discussed. Her training, which next comes under scrutiny, is clearly of the greatest importance and the Working Party have made some important recommendations for the future: they advise a common basic training for nurses and midwives and the union of the present

<sup>1</sup> For particulars, see p. 274.



Part I and Part II of the State Certificate Examination of the Central Midwives Board into one examination; this would normally be held after one year's training, which would be divided into three equal periods—normal midwifery, district midwifery, and abnormal midwifery. They go on to examine pay, promotion and the working and living conditions, and make many valuable suggestions. They stress the importance of proper avenues for promotion for both domiciliary and institutional midwives. We must all agree that this is a most important point if the right sort of woman is to be attracted to the profession. They are certain that proper transport must be made available and they insist that the midwife must have adequate means of relieving labour pain.

The chapter on recruitment brings into the open the much

wider issue of the use that is to be made of available woman-power in the country. Clearly there are not enough girls from secondary schools to meet the many and varied demands for them, so that women over 30 and even a few over 40 must also be attracted into midwifery; for them a more individual training may have to be arranged.

Many other interesting matters are discussed and important conclusions reached which cannot be mentioned in this brief review. It is a time of great change, and, with the start of the National Health Service, new difficulties and opportunities will present themselves. The Working Party have clearly been aware of these and they have recommended in the strongest terms that the whole subject be reviewed in three to five years' time.

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### 1478 Management in Obstetrics

Andrew M. Cloye. London: Geoffrey Cumberlege, Oxford University Press, 1948. viii + 186 pages; 17 figures. 19 x 12 cm. 12s. 6d. [£0.625]

(i) Abortion; (ii) antenatal supervision; (iii) breech in pregnancy; (iv) diet in pregnancy; (v) twins; (vi) excessive vomiting; (vii) retroversion with pregnancy; (viii) fibroids with pregnancy and labour; (ix) pre-eclampsia; (x) ante-partum haemorrhage; (xi) management of labour; (xii) forceps delivery; (xiii) relief of pain; (xiv) difficulty with shoulders; (xv) occipito-posterior position; (xvi) breech in labour; (xvii) force and breech presentations; (xviii) transverse lie; (xix) prolapse of cord; (xx) obstetric operations; (xxi) the force membranes; (xxii) low puncture of the membranes; (xxiii) post-partum haemorrhage; (xxiv) resuscitation; (xxv) puerperium; (xxvi) retention of urine; (xxvii) breast feeding; (xxviii) intramuscular injection; (xxix) on calling in consultants; (xxx) instructions on masks; (xxxi) prevention of puerperal sepsis. Appendices. Index.

Professor Cloye has written a practical manual of obstetrics intended especially for the general practitioner-obstetrician. In his preface he points out the need for an improvement of present standards of midwifery and for better training of those undertaking it. This book should contribute perceptibly towards such an improvement. It consists of a series of short but brilliant essays on all the topics with which an obstetrician is likely to be concerned and constitutes an excellent revision course in practical obstetrics.

There are a few minor points for criticism. Many of the references given are out of date. This may be due to delay in publication necessitated by post-war conditions and no doubt these defects will be remedied in later editions. De Ribes' bag, rightly condemned as obsolete in the treatment of placenta praevia, is recommended for the treatment of uterine inertia—dangerous advice and difficult to carry out even in a well-equipped hospital. The value of penicillin for mastitis and breast abscess is not adequately emphasized nor is the necessity for adequate dosage.

These criticisms are not meant to detract from the excellence of the book as a whole. The emphasis throughout is on the practical aspects of midwifery and the style is so clear and the use of words so economical that it contains as much useful information as will be found in many larger books.

It can be thoroughly recommended to the general practitioner-obstetrician for whom it is chiefly intended. Many experienced obstetricians, also, will find it useful. The book is representative of the best in modern British obstetrics.

Josephine Barnes

### 1479 Practical Obstetrics

Bruce T. Moyes. Sydney: Australasian Publishing Co. Ltd. (Distributors: George G. Harrap & Co. Ltd.), 1948. xv + 306 pages; 20 coloured plates; 123 figures. 23 x 16 cm. £2 5s. [£2.25]

(i) Post-partum haemorrhage; (ii) breech presentation (including Lovsett technique); (iii) local anaesthesia to the pelvic floor and perineum; (iv) episiotomy; complete tear of the perineum—technique of repair and nursing care; (v) occipito-posterior; (vi) forceps delivery; (vii) the long labour and its management; (viii) lower segment Caesarean section; (ix) pre-eclamptic toxæmia; (x) diagnosis and management of toxæmia of pregnancy; (xi) eclampsia; (xii) hydatid mole and toxæmia of pregnancy; (xiii) induction of labour; (xiv) induction of therapeutic abortion—hysterotomy; (xv) sterility; (xvi) sterility (continued); (xvii) artificial insemination; (xviii) acute inversion of the uterus; (xix) abdominal pregnancy; (xx) the Rh factor in pregnancy; (xxi) rubella and

pregnancy; (xxii) queries and views; pethidine, caudal analgesia; diabetes and pregnancy, dysmenorrhoea, Caesarean section in placenta praevia, Hoggben (Zenopus) pregnancy test, constipation in pregnancy, thrombosis in obstetrics, brow presentation, pyridoxine in morning sickness and hyperemesis. Index.

In 1944 the author wrote a series of bulletins on obstetrics for war-time graduates in the fighting Services. Each of these original contributions has been expanded and the series now appears in book form. Professor Bruce Moyes of Sydney University was persuaded to put his experience in a practical form so that graduates who had been divorced from the practice of obstetrics during the war would be able to revise quickly the more usual complications of obstetrics they would meet in general practice. Most obstetrics in Australia is done by the general practitioner, a person who has had a sound training. But in the words of the author—"Nevertheless, certain difficult problems persist whose solutions are by no means a matter of routine management, and which, in the event of failure, can be humiliating, even in the face of conscientious effort."

The contents of the book are such that they cover those abnormalities with which every general practitioner should be able to cope. Appropriately, the first chapter is devoted to post-partum haemorrhage. All would agree that this subject should occupy first place since there are still many maternal deaths from this complication; haemorrhage now occupies second place as a cause of maternal mortality. The author has devised an interesting method of presenting the subject. Two cases are fully discussed and the method of treatment is carefully elaborated. The advice he gives is clear and unequivocal and any reader following this would have no difficulty in dealing adequately with the emergency.

Since this edition was published practice has been changing and oxytocic drugs are being given before the delivery of the placenta. They are being used not only for the control of haemorrhage due to retained placenta, but also as prophylactic treatment. In some clinics complicated deliveries are given pitocin (5 units) or ergometrine (0.125 mg.) with the birth of the head or shoulder. Again, removal of the placenta in the absence of haemorrhage is performed within an hour of delivery. The colour plates showing eight manoeuvres of the operation of manual removal are so clear and original that they should be included in every obstetric textbook.

There are, in addition, 18 other coloured plates and 123 illustrations, all of which emphasize the value of visual aid in teaching. In the chapter on breech delivery, 26 illustrations are used to show the different complications and methods of extraction. The author was one of the first to use the Lovsett technique for delivering extended arms. By this simple method foetal mortality due to this complication has been considerably reduced.

The description of the lower segment caesarean section operation is so clear that a novice would not fail to appreciate each step. The operator wears two gloves on the right hand until the delivery of the placenta when the outer one is removed. The head is delivered into the uterine wound by using the hand as a lever. This method has much to commend it.

The author has succeeded admirably in his intention of presenting his subject in a number of practical clinical discussions rather than in the form of a textbook. His is an original method of presentation and the advice throughout is given by one who is obviously a versatile teacher and practitioner of obstetrics.

W. C. W. Nixon

**1480 Textbook of Midwifery**

Wilfred Shaw. Third edition. London: J. & A. Churchill Ltd., 1949. xiv + 649 pages; 4 plates; 235 text figures. 22 x 14 cm. £1 2s. 6d. [£1.125]

Section I. Physiology of reproduction. (i) Anatomy, physiology and embryology; (ii) anatomy and physiology of pregnancy; (iii) physiology of labour. Section II. Clinical midwifery. (iv) Symptoms and signs of pregnancy; (v) pre-natal examination; (vi) pre-natal advice to pregnant women; (vii) asepsis and antisepsis in midwifery; (viii) normal labour; (ix) management of the puerperium; (x) analgesia and anaesthesia during childbirth. Section III. Complications of pregnancy. (xi) Pregnancy complicated by maternal diseases; (xii) gynaecological complications of pregnancy; (xiii) pathology of pregnancy; (xiv) toxæmias of pregnancy. Section IV. Abnormal labour. (xv) Mal-presentations; (xvi) multiple pregnancy; (xvii) obstetrical haemorrhages; (xviii) contracted pelvis; (xix) the use of radiology in obstetrics; (xx) abnormalities of uterine action; (xxi) obstructed labour and rupture of the uterus; (xxii) injuries of the birth canal; (xxiii) complications of the third stage of labour; (xxiv) abnormalities of the puerperium. Section V. Abnormalities of the amnion, placenta, umbilical cord and foetus. (xxv) Abnormalities of the placenta. Section VI. Management and diseases of the new-born. (xxvi) Care of the new-born baby. Section VII. Operative midwifery. (xxvii) Obstetrical investigations and operations; (xxviii) the clinical aspect of cases of difficult and prolonged labour. Section VIII. Results and statistics. (xxix) Maternal and foetal mortality and morbidity. Index.

That there is a long time-lag between the handing of the manuscript by the author to the publishers and the appearance of his work in the bookshop is well illustrated by this book in the sentence "when penicillin becomes available for general use. . .". Penicillin has been generally available for at least three years and yet we find a book published under the date 1949 referring to conditions of three or four years ago. This is no fault of the author, but it is nevertheless a serious disability from which British books on medicine must suffer in competition with those of other nations, and a depressing thought for the author who contemplates writing a book on a rapidly progressing subject. But, having made every allowance for the technical delays due to the printers and binders, Mr. Shaw retains opinions and teaches lines of action which have been discarded by most of us for twenty years.

Almost every chapter will show examples. External pelvimetry is given six illustrations and covers about four pages in the section on antenatal care and is again described in some detail in the section on contracted pelvis. Few obstetricians who work in association with their medical colleagues in a teaching centre would agree that dietary protein should be reduced in the treatment of toxæmia. The book is littered with examples of the teaching of bygone years of which we could give many more examples were space available. Uncritical acceptance and teaching of untried theories and methods is an equally serious error, but there is room for prudent discrimination so that the student may be taught the solid new knowledge which has proved its value.

A useful improvement in the next edition would be to bring certain maternal mortality statistics up to date. It is surely useless to quote the statistics of 1932 relating to deaths from various causes when the death rate from puerperal sepsis accounted for nearly half the total maternal mortality, and to devote a considerable space to comment on these obsolete figures.

However, despite these criticisms, the book presents a clear exposition of important general principles and essential details which are needed by the undergraduate. The section on the Rh factor, where a complex subject is clearly explained in simple language, is a good example of this.

A. W. Bourne

**1481 Diseases Affecting the Vulva**

Elizabeth Hunt. Third edition, revised. London: Henry Kimpton, 1948. 211 pages; 36 illustrations; 19 colour plates. 25 x 16 cm. £1 5s. [£1.125]

(i) Introduction; (ii) anatomy of the vulva; (iii) histology of the vulva; (iv) development of the vulva; (v) diseases affecting vessels; (vi) diseases of glands; (vii) anomalies of pigmentation; (viii) inflammation of the skin; (ix) inflammation of the skin (continued); (x) drug eruptions; (xi) affections in general and visceral diseases; (xii) urticaria; (xiii) lichen simplex chronicus; neurodermatitis; (xiv) intertrigo; (xv) psoriasis; (xvi) seborrhoeic dermatitis; (xvii) lichen planus; (xviii) leucoplakia. Leucokeratosis; (xix) kraurosis; (xx) ulcers of the vulva; (xxi) malignant neoplasms; (xxii) benign neoplasms and hypertrophies; (xxiii) microbial affections; (xxiv) vaginal and intestinal organisms; (xxv) tuberculosis; (xxvi) venereal diseases; (xxvii) venereal diseases (continued); (xxviii) venereal diseases (continued); (xxix) parasitic infections; (xxx) diseases due to filter passing viruses; (xxxi) affections in children; (xxxii) pruritus. Appendix I: the pH scale. Appendix II: treatment. Index.

The fact that Dr. Elizabeth Hunt's book, which was first published in 1940, is already appearing in its 3rd edition is in itself an indication of its usefulness.

It is a complete treatise on all diseases of the vulva, including venereal diseases. As the author very rightly points out, such

diseases must be considered, not as entities, but as part of some general condition. She objects to the term vulvitis being applied, for instance, to a skin eruption affecting the labia majora and also the thighs and lower abdomen; and she emphasizes the fact that when a patient complains of vulval irritation, the whole patient must be systematically examined.

This book of 211 pages is divided into 32 short chapters and this arrangement makes it easy to look up any particular condition. The descriptions of skin lesions are unambiguous and vivid, so that it should be easy for anyone to visualize the condition without previous knowledge of it. The 19 coloured photographs of vulval conditions are excellently reproduced from Dufay films, and are clear and instructive. One slight criticism is that the plates are scattered through the text, not necessarily in the chapter to which they refer. The references to the plates in the text do not state the number of the page facing the plate; the plate number only is given.

Treatment forms a prominent part of each chapter, and there are a number of excellent prescriptions. This edition has been brought up to date by the inclusion of new remedies such as penicillin, but no reference is made to the antihistamine drugs. This omission will probably be remedied in later editions. There is a very valuable list of external agents which may produce inflammation of the skin. The author stresses the fact that alkaline baths, which are so commonly resorted to by patients suffering from pruritus vulvae, are actually themselves one of the causes of dermatitis venenata. There is a chapter devoted to the vulval affections in childhood, which include a number of conditions from napkin rash to gonorrhoea. The statement that non-gonococcal vulvovaginitis of children usually clears up in two or three weeks is rather surprising. The chapter devoted to pruritus vulvae is instructive; the possible causes are clearly set out and there are valuable suggestions for treatment. It is interesting to see that the author states that x-ray therapy is rarely indicated in vulval affections, though she advocates both ultra-violet light and grenz-ray therapy in certain cases.

Altogether it may be said that this book will prove valuable to general practitioners and gynaecologists as well as to dermatologists.

I. M. Gaddum

**1482 Die gynäkologischen Operationen und ihre topographisch-anatomischen Grundlagen**

Heinrich Martius. Fifth edition. Stuttgart: Georg Thieme, 1947. xvi + 424 pages; 427 illustrations. 26 x 17 cm. 58 Mk.

(i) Die gynäkologischen Laparotomien; (ii) die vaginalen Operationen; (iii) die Operationen wegen Häminkontinenz; (iv) die Ausschabung der Gebärmutter; (v) die Hysterotomien; (vi) Operationen am Darm. Sachverzeichnis.

The 5th edition of this work should be of great value not only to the postgraduate student but also to the experienced operator. The illustrations are excellent; they consist of coloured diagrams showing the progressive manipulations in the course of each operation. This type of illustration is clearly more effective than photographs when proceedings in the depths of the abdomen are being presented, since by emphasizing light and shade the essential points can be more clearly demonstrated.

In cases of abdominal myomectomy, the author prefers supra-vaginal amputation to total hysterectomy because of the lower operative mortality and because, in his view, the danger of the occurrence of a later carcinoma in the cervical stump is almost negligible (0.32-0.39 per cent). In younger women he favours conservative myomectomy to make a later pregnancy possible, in spite of the risk of recurrence of another myoma.

Wertheim's operation for total hysterectomy in carcinoma of the uterus is clearly illustrated and fully described. The author does not advise the removal of all the regional lymphatic glands; in his view only neoplastic glands should be extirpated. However, whether lymphatic glands are cancerous can be decided only by histological examination, and this would unduly prolong the operation.

The author confirms the view that every ovarian cyst should be removed as soon as it is diagnosed. He points out the danger of ovarian cysts in pregnancy; they can form an obstacle to delivery by becoming incarcerated in the pouch of Douglas.

The concluding chapter on certain abdominal operations which the gynaecologist is sometimes called upon to perform is especially welcome. In summary, the volume provides a comprehensive and authoritative description of all the major procedures in operative gynaecology; it should prove stimulating reading for all those interested in the subject.

O. Burger

## CHILD HEALTH

1483

## NEONATAL MORTALITY

PROFESSOR DUGALD BAIRD

*Department of Midwifery  
University of Aberdeen*

This Report is the work of a joint committee of distinguished obstetricians and paediatricians representing the Royal College of Obstetricians and Gynaecologists and the British Paediatric Association. Its scope is much more comprehensive than the title suggests, since stillbirths are considered as well as neonatal deaths. The subject is dealt with in 10 chapters, chronologically, from conception to the neonatal stage. The contents of the Report<sup>1</sup> are well indicated by the chapter headings. A noteworthy point is the lists of references which follow each chapter, and which together form a comprehensive and valuable guide to the literature.

In a short statistical analysis, which opens the Report, it is concluded that the present neonatal mortality and stillbirth rate could be reduced by one-third to one-half; this would result in the saving of some 15,000 babies each year in England and Wales.

Apart from the general recommendations of the committee, which form the last chapter, certain conclusions are drawn and suggestions made in the course of the Report. In discussing the use of analgesics in childbirth, the conclusion is reached that the ideal anaesthetic has yet to be discovered; also, it is recommended that the appointment to all maternity hospitals of full-time resident anaesthetists, with obstetrical experience, should be considered. The beneficial effects of improved social and economic conditions and of higher nutritional standards on the stillbirth and neonatal death rates are pointed out, instrumental interference in labour is discussed and it is urged that "the treatment of the child injured during birth is of great importance and should be in the hands of an experienced paediatrician who can call upon the assistance of suitably trained nurses."

In certain respects the Report is disappointing and some of the chapters are rather difficult to read, owing in part, at least, to the use of numerous tables of statistics from hospital reports, which by their very nature must have limited value. This point is well illustrated in the chapter dealing with pre-eclamptic toxæmia. It is stated, for example, that the foetal mortality from toxæmia is 46% in Newcastle, and 21% in Liverpool, and that this difference may be explained by the large amount of industrial depression in Newcastle at the time. The year is not given, however, and no evidence is furnished to indicate how the amount of industrial depression was calculated. The Report states that the percentage of all stillbirths assessed as due to toxæmia is the same in both places (20%). But we are told that the neonatal deaths per 100 live births in Manchester and Newcastle were 9.7 and 19.8, respectively. From figures given in the table it is possible to calculate that the abortion and stillbirth rates in the same

series of cases are 21 and 14 per 100, respectively, but no comment is made to explain why there are more neonatal deaths, and fewer stillbirths and abortions due to toxæmia, in Newcastle than in Manchester. In Dublin, 16% of premature births are to mothers with toxæmia, corresponding percentages for Belfast and London being 49 and 30. It is clear that no conclusions can be drawn from these figures and there seems little point in including them in the text.

Under the heading of "Research" the committee states that medical reports of maternity hospitals should be standardized. (A standard form of annual report for maternity hospitals has been drawn up by the Royal College of Obstetricians and Gynaecologists.) While it is important that maternity hospitals should keep accurate records of their results, there are limits to the usefulness of these. They may be helpful in assessing the relative value of various methods of treatment, but they cannot be used, as they are in this Report, to compare the incidence of pathological conditions in various parts of the country. For this purpose data collected on a regional basis are required. This is, of course, difficult, but should become easier administratively under the National Health Service. The collection of mortality data is comparatively easy but, with regard to morbidity, the difficulties of securing uniform standards of definition, observation and recording, even in the large teaching hospitals, are great, while on a regional basis, i.e. in smaller hospitals and in domiciliary practice, they are very great indeed. Till some such information is available, comparison between one region and another cannot be made and the use of hospital statistics can be very dangerous. The results, besides being influenced by the efficiency of medical treatment, are also affected by the proportion of "booked" and "non-booked" cases, and by the type of district which the hospital serves. There is a correlation between the type of district and such factors as health, physique, age, parity of the mothers, and the amount of co-operation of the patients. The last named may closely affect the possibility of early diagnosis and treatment.

It seems worth while to re-emphasize several salient points stated in the Report but scattered throughout its pages in such a way that they may be overlooked by the average reader.

Under the best existing conditions, i.e. in the Registrar-General's social classes I and II, where the standard of medical and nursing care is generally very good, the stillbirth and neonatal mortality rates are low—in each case about 10 per 1,000 births. This superiority over the general rate is unlikely to be due to any genetic superiority in the power of physical survival. It must therefore be due to the benefits of optimal environment, i.e. housing, exercise, hygiene, food and education. No amount of expenditure of money and effort on improving medical and nursing services will, by itself, reduce to the lowest possible level either the stillbirth or the neonatal mortality in social classes IV and V, which constitute about 40% of the population. Unless a high standard of medical care is accompanied by a greatly improved standard of living for "the masses" its results will be disappointing.

In the light of this general statement it is disappointing that the committee decided to make only a short general recommendation about research and limited itself to the

<sup>1</sup> *Neonatal mortality and morbidity.* For particulars, see p. 274.

advocacy of three routine procedures. The first deals with the standardization of medical reports in maternity hospitals and has already been commented upon. The second recommends that "post-mortem examination of babies born dead or dying in the neonatal period should become the rule . . ." While it is of course important to see that this is done, the limitations of a routine procedure as a method of research should be stressed. It has been pointed out by several writers that even where post-mortem examination has been done as a routine, over 30 % of foetal deaths still remain unexplained, even when no account is taken of the 10 % of stillbirths where the foetus is too macerated to make examination profitable. The autopsy may show asphyxia, cerebral haemorrhage or atelectasis; that is, it may show how the baby died but not why. If the mother's health has been good during pregnancy and the labour "normal", the problem is even more obscure. In nearly 50 % of stillbirths and neonatal deaths the baby is premature—5½ lb. (2.5 kg.) or under. The premature baby is very liable to die from any of the three causes mentioned above so that prematurity, while not the actual cause of death, is a most important predisposing factor, so much so that, in most cases, in the absence of prematurity foetal death would not have occurred. The study of the causes of prematurity is therefore a most important project for research, especially since it is estimated that in about 50 % of cases the cause is unknown.

The third recommendation calls for a general adoption of the accepted standards of immaturity and prematurity, the

words being used synonymously. Surely something much more comprehensive is necessary. How far is the weight of the baby an index of maturity? How often does the baby weigh less than 5½ lb. at birth because it has been born prematurely? Small women, under 61 inches (1.55 m.) tall, constitute a large proportion of those living in the poorer parts of our large cities and they give birth at full term to babies of 5½ lb. (2.5 kg.) or less in about 20 % of cases. Do these babies suffer any disadvantage as a result of this, and how do they differ from babies of the same weight born at about 36 weeks to taller women? What factors determine the birth-weight, length and vitality of the baby? A comprehensive study of the physiology of human pregnancy seems indicated.

There is great scope for the research worker in the field of obstetrics. More information is required about the physiology of pregnancy in general and pre-eclampsia and uterine dysfunction in particular. The creation of more whole-time senior clinical posts both inside and outside the universities should increase the chance of work of this type being undertaken. The task before the administrator and the practical obstetrician and paediatrician is the general application of what is already well known. The results achieved will depend on their efforts, and on progress in education, housing and the future economic position of the country. The large amount of information in the present Report is a valuable addition to knowledge and will make the task easier.

\* \* \*

#### 1484 Annual Report on Child and Youth Welfare, Based on Information Received from Member Governments Between 1 April 1947 and 31 March 1948

United Nations, Department of Social Affairs. Lake Success,  
New York: United Nations, 1948. 236 pages. 23 × 15 cm.  
12s. 6d. [£0.625]

The General Assembly of the United Nations have "authorized the publication of an Annual Report on Child and Youth Welfare based on and summarizing information transmitted by Member Governments and having for its purpose to provide, each year, particulars of the progress made in child and youth welfare in the various countries, from both the legislative and administrative points of view." The first of these reports, which is a continuation of similar reports published by the League of Nations Secretariat, has now been published and contains not only a general survey of the situation as regards child welfare at the present time but, in many instances, it also covers the war years. Following a letter from the Secretary-General, 32 countries have forwarded information to the Secretariat. Some of the countries have interpreted the term "child welfare" to include only those measures which protect and support the child when normal parental care breaks down or is destroyed, but others have given a wider interpretation and have touched on those services which contribute to the child's material, physical and psychological well-being, either in its own home or elsewhere. This, in many cases, has included information on the care of the expectant and nursing mother.

The report, as a whole, shows that countries which before the Second World War showed little, if any, interest in maternal and child health, are now beginning to plan programmes for their areas. In such areas, the fundamental problem is the training of personnel, not only for the preventive child health services, but also for the hospital services. Hospital beds, too, are in short supply even though personnel may be available. In the programmes for education in health matters great and increasing use is being made of

broadcasting, and this would appear to be particularly useful in countries where a large proportion of the population is illiterate. In some areas, where the population is scattered, information is given by the regular despatch of letters to mothers with young children, giving them advice on how to bring up these children. In other areas there are mobile clinics, sometimes in motor vehicles, while in others, there are maternal and child welfare units housed in railway cars. Some States undertake the whole of the responsibility for child care, while others put the responsibility on voluntary organizations, paying a subsidy towards their cost. In those countries where the State assumes responsibility, the organization of these services may rest entirely with the central government, whereas in others, the responsibility is placed on local municipalities with financial aid from the central government.

The problems of countries recently under enemy occupation are very similar, whether they be in the Far East or in Europe, and in these the toll of child life during the war years has been heavy. Many countries are still at the stage when they have to organize registration of births and deaths so that they may have a "yardstick" with which to measure their progress. In some countries the effect of the occupation on the adolescents has been particularly severe, not only with regard to delinquency but also on the rate of their growth and development. Family allowances are becoming more frequent and these are, in some cases, supplemented by mothers' allowances, which are paid to the mother to make it unnecessary for her to go out to work. The course of development of provision for the care of boarded-out children, placement of children for adoption, and for delinquent children, is much the same in many countries. In one area at least pre-nuptial medical certificates are required from both spouses. These certificates are not meant to prevent undesirable marriages but are merely to make each partner aware of the physical condition of the other.

Altogether, in reading this report, an encouraging picture is presented of the efforts which are taking place throughout the world to improve child health.

Jean Mackintosh

## 1485 The Premature Baby

V. Mary Crosse. Second edition. London: J. & A. Churchill Ltd., 1949. viii + 167 pages; 14 figures. 21 x 14 cm. 12s. 6d. [£0.625]

(i) Definition and characteristics; (ii) general scheme of management and care; (iii) institutional care; (iv) home care; (v) clothing; (vi) methods of feeding; (vii) complications liable to occur in the premature baby; (viii) statistics in relation to the premature baby. Appendix. Index.

The chief value of this volume lies in the detailed description of the organization, equipment and methods employed at the Sorrento Premature Baby Unit, Birmingham. The emphasis on practical details makes the book useful to anyone responsible for the running of such a unit, and the somewhat dogmatic approach employed by the author is justified by her results.

The larger part of the book describes the methods used at the Birmingham centre, together with the instructions given to the nursing staff. Of special interest is the chapter on the care of the premature infant in its own home, and the notes on the training of the mother in the care and after-care of her child. Sound advice is given on the choice of clothing, and the exact technique of pipette, oesophageal and gastric feeding is described, together with tables showing nutritional requirements. The danger of overfeeding in the early days is adequately stressed.

The usual list of modified milk foods is given, but the reviewer feels that a definite statement about the feeds used at the unit might have been more useful than a mere enumeration of them. Also the value of a separate milk room might have been stressed more forcibly.

The chapters on complications and illnesses occurring in premature babies are—perhaps intentionally—somewhat brief. The treatment advised for atelectasis seems unduly conservative in view of the good results obtained by skilled endoscopic removal of secretions from the bronchial tree. The statements that antibiotics are valueless in gastroenteritis, and that replacement transfusion is not warranted in haemolytic anaemia, will also need revision. Lastly, the technique for subcutaneous, intravenous and intramedullary infusions might have been described in greater detail.

The book ends with a valuable statistical appendix on the incidence, distribution, cause and complications of prematurity.

B. Gans

## 1486 Clinical Pediatrics

I. Newton Kugelmass. Second edition. New York: Oxford University Press; London: Geoffrey Cumberlege, 1947. 409 pages. 22 x 14 cm. 12s. 6d. [£0.625]

(i) Growth and development; (ii) diseases of the newborn; (iii) nutritional disorders; (iv) diseases of the eye; (v) respiratory disorders; (vi) circulatory disorders; (vii) blood disorders; (viii) urogenital disorders; (ix) skin disorders; (x) bone and joint disorders; (xi) diseases of the nervous system; (xii) infectious diseases; (xiii) neuropsychiatric disorders. Index.

In his preface to *Clinical Pediatrics* the author states that "the purpose of this epitome is to emphasize the determining features of pediatric problems." Whatever this may mean, it is difficult to imagine to what use the book could be put. It is arranged in the manner of lecture notes under headings of diseases, each heading followed by a profusion of alphabetically and numerically arranged sub-headings—none, incidentally, being provided for prognosis, which is not considered. The book is of little value to the undergraduate as its arrangement makes reading difficult. More important, the amount of space given to individual conditions bears no relation to their relative importance: chronic bronchitis receives 14 lines, whereas porphyria has 70, and the Hand-Schüller-Christian syndrome 116! Apart from these errors of emphasis the text is often vague, and statements that "a small head is associated with defective brain development" and "the chief cause of [premature] death is cerebral hemorrhage, prevented by prenatal vitamin K therapy" are of little use to the undergraduate student.

Neither can the book be recommended as a reference work, as the index is poor, the treatment is superficial, there are no references, and, more important, the text is full of the most astonishing number of inaccuracies and omissions. These are too numerous to mention more than a few: "Chronic parenteral focus of infection is the most common cause [of celiac syndrome]." "Catarrhal jaundice is due to swelling and obliteration of the biliary passages"—no mention of a virus. "Increased blood destruction is the underlying cause [of physiologic jaundice]"—the hepatic immaturity is not mentioned. The section on cardio-vascular diseases is perhaps the most astonishing, as these two random samples will show: "patent ductus" is associated with "pulmonary stenosis, transposition of great vessels or stenosis of the aorta" and "Increased intracranial pressure... may cause malignant hypertension." Lastly, the following quotation will give an idea of the type of English the author indulges in: "Grape sugar is the coin of currency of animal life."

In view of these serious shortcomings it appears particularly regrettable that Oxford University Press, from which one has come to expect a high standard, should have published the book.

## NEUROLOGY AND PSYCHIATRY

## 1487 Modern Discoveries in Medical Psychology

Clifford Allen. Second edition. London: Macmillan & Co. Ltd., 1949. xi + 236 pages. 22 x 14 cm. 12s. 6d. [£0.625]

(i) Mesmer and the discovery of hypnosis; (ii) Janet and the structure of consciousness; (iii) Morton Prince and multiple personality; (iv) Freud and the discovery of psychoanalysis; (v) the further discoveries of the psychoanalysts; (vi) Adler and the power instinct; (vii) Jung and the hinterlands of the mind; (viii) Kretschmer and the relation of body and mind; (ix) Pavlov and the machinery of the mind; (x) Wagner-Jauregg and his followers. Index.

The reasons for the success of previous editions of this book and for its translation into several languages are not far to seek. It gives a succinct, accurate, and entertaining if necessarily somewhat superficial account of the historical evolution of psychopathology from Mesmer to Freud and his followers. Kretschmer's work on the relation between physique and temperament is discussed, and there is an excellent account of Pavlov's discoveries and their psychiatric implications.

The volume is intended primarily for neophytes in the field of psychiatry and is an excellent historical introduction to the subject. It could however be read with profit by any educated layman and the literary style is not one which would offend his susceptibilities. It is a common American criticism of British psychiatry that in its anxiety to avoid speculation it tends to become mechanistic, and to find refuge in a pessimistic genetic determinism. It is refreshing to read a British psychiatric author who is not afraid of speculation and who can write of psychopathology with understanding and without patronage.

The last chapter deals with the newer physical methods of treatment of psychiatric illness. The author points out that these advances are not yet completely evaluated and that routine applications of such methods without careful preliminary psychiatric study of the individual patient can lead only to rule of thumb practice and a progressive lowering of standards.

Henry G. Miller



1488 **A Text-book of Mental Deficiency (Amentia)**

A. F. Tredgold. Seventh edition. London : Baillière, Tindall & Cox, 1947. xvi + 534 pages ; 9 tables ; 47 plates. 22 x 14 cm. £1 10s. [£1.5]

(i) The concept and nature of mental deficiency ; (ii) incidence ; (iii) aetiology ; (iv) classification and definitions ; (v) psychology ; (vi) pathology ; (vii) physical characteristics of amentia ; (viii) idioy ; (ix) imbecility ; (x) feeble-minded children ; (xi) educational defect and disability ; (xii) feeble-minded adults ; (xiii) the clinical varieties of primary amentia ; (xiv) secondary amentia and its clinical varieties ; (xv) idiots savants ; (xvi) moral deficiency ; (xvii) amentia with other forms of mental disease ; (xviii) clinical examination ; (xix) diagnosis and prognosis ; (xx) treatment and training ; (xxi) the law of England relating to mental defectives ; (xxii) sociology—the ament and the community. Appendix: the case of Neville G. C. Heath. Index.

In the forty years of its existence this volume has become an institution. The 1st edition brought a new attitude of mind to the subject of mental deficiency and, now in its 7th edition, having been responsible for the bulk of textbook education in this subject in several continents, this book remains by far the most comprehensive and satisfactory work on mental deficiency.

The strength of this new edition lies as before in the powers of description of the author. All the known syndromes are described with a care worthy of the great traditions of British clinical medicine. The chapters on practical procedure are clear and concise. They have been invaluable in the past and will be a godsend to a new generation of medical officers. The passage of the Education Act, 1944, has materially altered the administrative aspects of the subject and the author has brought this edition right up to date in these matters.

On re-reading this book, one cannot help wondering how the wide-spread idea that mental deficiency is mainly or even entirely a matter of intellectual failure was ever propagated. Few people would admit such a belief if directly challenged but it is implicit in much thinking and planning for mental defectives. This volume brings into sharp relief the fact that mental deficiency is a state of deficiency of all the attributes, physical, mental and moral ; though the emphasis may vary from case to case.

It is not the author's fault that he has most to say about the cases which are met with the least. Although the feeble-minded are fifteen times as common as idiots, physical and mental anomalies are naturally to be met with far more often towards the lower end of the scale. At the upper end the quiet, well-behaved defectives with nothing particular to show for themselves greatly outnumber the others. A textbook on mental deficiency which started by describing the life of the "social problem" group family and how the world appeared to the dull children brought up in this group with all its social complications, and thence working down the scale to the cases of gross defect, might enable the medical profession to see a new perspective.

The author does not expect everyone to accept his description of "moral deficiency" ; nor will readers trained in concepts of dynamic psychopathology find this section of the book satisfying. No doubt his contention that those who show chronic antisocial traits may on this account be deemed feeble-minded in the strictest sense of that term is legally justified ; but few practitioners dare to interpret the definition in a non-cognitive sense. Many will feel that this obscure subject receives more illumination from the application of principles derived from the study of the dynamic modifications of instinctive drives in childhood. Undoubtedly, moreover, the chapter on psychology would be more satisfactory if brought more up to date.

It was probably unwise to attempt to describe the case of the murderer Heath in an appendix, partly because the subject is of too ephemeral interest to merit inclusion in an enduring book, and partly because the *Times* law reports on which the account depends can give very little light on motive. The case, in fact, demands a psychoanalytical type of approach to render it comprehensible.

The lay-out of the book is refreshingly good after wartime standards and the illustrations are excellent. For a combination of pictorial and anecdotal description, of clinical observation and statistical fact, of humanitarian understanding and legal practical-mindedness this book remains unique.

Kenneth Soddy

1489 **Modern Practice in Psychological Medicine, 1949**

Edited by J. R. Rees. London : Butterworth & Co. Ltd., 1949. xii + 475 + 13 pages. 25 x 17 cm. £2 10s. [£2.5]

(i) Health ; (ii) ourselves—the normal individual ; (iii) abnormal psychology in relation to emotional development ; (iv) the diagnostic interview ; (v) intelligence—its ascertainment and significance ; (vi) the types of personality ; (vii)

psychosomatic medicine ; (viii) psychiatry and neurology ; (ix) nature and nurture—the factor of inheritance ; (x) development and care of the child ; (xi) anxiety states ; (xii) hysteria ; (xiii) obsessional states ; (xiv) sexuality and the sexual disorders ; (xv) abnormal and delinquent conduct ; (xvi) mental deficiency ; (xvii) depression and mania ; (xviii) the schizophrenic disorders ; (xix) the organic reaction types ; (xx) physical methods of treatment ; (xxi) psychotherapy ; (xxii) industrial stress and psychiatric illness ; (xxiii) medical social work ; (xxiv) psychiatric social work in Great Britain ; (xxv) the medico-legal aspects of psychiatry. Appendix: classification of psychiatric illness. Index.

This book, intended for medical students and general medical practitioners, covers the entire field of psychological medicine, as well as the relationship of psychiatry to other medical and social disciplines. Apart from chapters on the conventional subjects of mental medicine—the various neurotic and psychotic syndromes, their causation and their treatment—there are important contributions from workers in child psychiatry, delinquency, sex abnormality, and psychosomatic medicine, as well as introductory chapters on the problems of personality, psychopathology, and the psychological management of patients. Finally there is a very clear and adequate treatment of the legal aspects of psychiatric illness, and of the increasingly important role played by the general, and especially the psychiatric, social worker.

The 29 contributors are all specialists in the subjects which they treat, so it would be impertinent to criticize their facts or method of presentation except from a very general point of view. Not all aspects of psychiatry are of equal interest and significance to the general practitioner. The more felicitous presentations are, on the whole, on subjects of general importance, in the chapters headed "Industrial stress and psychiatric illness", "Psychotherapy", "Development and care of the child", and "Nature and nurture: the factor of inheritance". The authors dealing with more specialized aspects of psychological medicine have perhaps not always been equally successful in presenting their material with sufficient selection of essentials, and have tended to deal too fully with matters of special significance to themselves rather than to the general medical reader. For instance, a full and academic review of Spearman's work on intelligence seems as much out of place in a book of this kind, as a lengthy discussion in the chapter "Psychosomatic medicine" on the psychological effects of blindness, while appropriate treatment of the much more frequently encountered emotional consequences of deafness is omitted.

Though the contributors of this volume are representative of all shades of psychiatric opinion in this country and America, and frequently there is some overlap between the presentations of several authors, certain chapters have appeared too dogmatic to the present reviewer. This seems particularly evident in the chapter on "Abnormal psychology in relation to emotional development", in which the author confines himself almost entirely to expounding Freudian theory without acquainting the student with the views of other schools of psychopathology. It is feared that such one-sided presentation is likely to antagonize the discerning and critical reader, when a broader, more eclectic and less dogmatic approach might have served to guide him towards realizing that the dynamics of psychological illness lie beyond the reach of unaided common sense.

On the other hand, in the treatment of most subjects the book is clearly intended for the mature and experienced reader, and a mere presentation of factual information in an easily assimilable form is evidently not intended. The authors do not conceal the inchoate state of psychiatric thinking and knowledge. Indeed, it seems doubtful whether this volume can be recommended to the average medical student unless he has already worked his way through an introductory textbook and has mastered the non-controversial aspects of mental medicine. It is much more suitable for the postgraduate student during specialist training in other medical subjects ; he will, on the whole, find in *Modern practice in psychological medicine* a very comprehensive and stimulating presentation of the state of psychiatric knowledge in this country today.

Felix Post

1490 **Lehrbuch der allgemeinen Kinderpsychiatrie, Einschliesslich der allgemeinen Psychiatrie der Pubertät und Adoleszenz**

M. Tramer. Third edition. Basle : Benno Schwabe & Co., 1949. 550 pages. 25 x 17 cm. 38 Sw. fr.

(i) Einführendes in die Kinderpsychiatrie ; (ii) Überblick über die psychologischen Betrachtungsweisen für die Kinderpsychiatrie ; (iii) der Massstab für die Entwicklung ; (iv) Untersuchungsmethodik ; (v) allgemeine Psychopathologie : Grundformen ; (vi) allgemeine Ätiologie ; (vii) Fortsetzung der allgemeinen Psychopathologie : besondere Formen ; (viii) Krankheitsformen ; (ix)

Diagnostik und Prognostik; (x) Therapie; (xi) soziale Funktion der Kinderpsychiatrie; (xii) Psychohygienische Aufgaben der Kinderpsychiatrie; (xiii) Abschliessendes; (xiv) Anhang: Kasuistik. Sachregister. Autorenregister.

This textbook on general child psychiatry appears in its 3rd edition, the 2nd edition having been out of print after only one year and a half. It consists of fourteen sections, each of which is divided again into several chapters and sub-chapters. The author calls his approach anthropobiological and likens it to that of Adolf Meyer and C. von Monakow.

A great deal of material has been collected and the work of many German, Swiss, French, and American psychiatrists is discussed, the chief being Homburger, Stirnimann, Hanselmann, Bühler, Baumgarten, Cotte, Schachter, Stern, and Kanner. Only a few British psychiatrists are mentioned such as Lowenfeld, Maberly, and Bierer. Most diseases of childhood, in which a change in the mental stage of the child may occur, are listed and discussed from the psychiatric point of view. In the section on general psychopathology we find chapters on instincts, drives, affects and moods, intelligence, character, and so on. The author particularly concentrates on the description of types. Amongst about 60 types he has collected we find descriptions of such types as the "abnormally cheerful", the "abnormally irritable", the "abnormally sad", and the "indifferent".

The author believes that in childhood up to the age of puberty one is dealing mainly with pre-neurotic or pre-psychotic states and not with psychoneuroses or psychoses in the adult sense. Many British psychiatrists will consider that the author does not sufficiently acknowledge the fact that there are specific forms of neuroses in childhood, such as the childhood phobias and obsessional states. He gives a few hints as to the diagnostic criteria of childhood psychosis, but he is of the opinion that in childhood schizophrenia and manic-depressive states are very rare. Many American and British child psychiatrists will disagree with this point of view and will maintain that the childhood form of schizophrenia and manic-depressive psychosis can frequently be found even in young children on thorough investigation. One would certainly agree with the author that diseases of childhood differ in their symptomatology from the same condition seen in the adult but nevertheless early diagnosis of serious childhood neurosis or psychosis is important, as the hope of satisfactory treatment depends on this. So often such children apparently recover, only to become more seriously ill again in adult life. The early diagnosis of a serious neurosis or psychosis is the more essential as treatment of very ill young children is proving to be more and more successful, particularly when treatment is by psychoanalysis.

The section on treatment deals both with somatic and psychotherapeutic methods. Under the heading "Individual psychotherapy" there are short chapters on the mother-child relationship, play therapy persuasion, suggestion, hypnosis, individual psychology, and psychoanalysis, etc. The fact that the author describes so many approaches has some disadvantages, as he does

not give a sufficiently clear picture of any one treatment. For example, the psychoanalysis of children is discussed on only one page. Anna Freud and Melanie Klein, the leaders of psychoanalysis of children, are mentioned, but the author does not refer to the progress made since 1920 when Melanie Klein introduced a new method of play analysis. In this, the observation of the child playing spontaneously with a few selected toys is used by the psychoanalyst in the same way as the free association in the adult analysis. With this method it has been possible to treat and cure even very ill young children. Under the heading of psychoanalysis the non-psychoanalytical methods of Stekel and Jung are also mentioned; this will be confusing to the reader.

The section on normal development is on the whole useful, but it is to be regretted that in discussing the infantile development of the first year of life, the work of English psychiatrists and psychoanalysts, such as M. Klein, S. Isaacs, M. Middlemore and D. Winnicott, is not mentioned at all. The author thinks that social contact between the infant and his mother exists from the second or third month onward, which is in agreement with the views of a number of child psychoanalysts who believe that a real emotional relationship between the baby and his mother exists from earliest infancy.

As the author stresses the importance of the early social contact of the infant with the mother one is surprised to read that he is mainly concerned with the question of disciplining the small infant. The mother is advised to maintain a friendly attitude to the baby, but there is no discussion of the problems and anxieties arising from the infant's helplessness and no discussion of feeding and weaning difficulties.

I have not been able to find in the whole book any detailed discussion of the question of toilet training and the problems arising therefrom. The only hint as to the author's view on this very important subject is his statement that one of the causes of enuresis may be that the toilet training of the baby has not been started *early enough*. Here again most British psychiatrists take the opposite point of view and maintain that toilet training should not be started early. They consider that if the major training in bowel and bladder habits is delayed until after weaning and until some degree of independence has been achieved later difficulties over control of bladder and bowels are more likely to be avoided.

Generally speaking, the problems of early infancy are insufficiently dealt with in this book. The author has chiefly concentrated on the problems of children between the ages of 6 and 16.

The value of this textbook is chiefly in that it gives a general survey of child psychiatry. Such textbooks are needed and Tramer is one of the few pioneers in this field. One hopes that in the next edition there will be more discussion of detailed diagnostic and therapeutic approaches, which will be useful to those who wish to specialize in this important field.

H. Rosenfeld

## TROPICAL MEDICINE

### BRITISH SCHOOLS OF TROPICAL MEDICINE

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When in 1885 the Colonial Powers of Western Europe, assembled at the Conference of Berlin, bound themselves "to promote the moral and material well-being of native populations" in the tropics they probably failed to recognize both

the immensity of their task and how ill-equipped they were to accomplish their self-imposed work. In the field of health alone there were few trained workers, and those medical men who had acquired some knowledge of tropical diseases had had painfully and laboriously to teach themselves. The causation of most tropical diseases was still largely unknown though in 1880 Laveran, by the discovery of malarial parasites, had dispelled the old theory of the role of miasmata in febrile conditions. Only in 1895, however, did Ross discover the process of exflagellation and the emission of microgametes in the mosquito and in 1898 the mosquito-transmission of an avian malarial parasite. In 1885 Bruce showed that nagana, the "fly disease" of horses, oxen, and other domestic mammals in Africa, was due to a trypanosome, since known as *Trypanosoma brucei*. It soon became ap-

parent that, if the fields opened up by these new protozoological discoveries were to be fully exploited, provision must be made for systematic teaching in these subjects so that properly equipped physicians might enter the field of tropical medicine. Thus it came about that at the turn of the century both in Great Britain and in Germany the idea of founding schools of tropical medicine was translated into fact.

The first of these schools was that at Liverpool which was founded by Sir (then Mr.) Alfred Jones on 12 November 1898. This School was officially opened in 1899 and the teaching of tropical medicine was begun in April of that year. It is of interest to recall that this School owes its origin not to the encouragement of Government departments but to the generosity and far-sightedness of Liverpool business men who were convinced that fundamental research and the provision of trained medical men were essential if trade with tropical countries was ever to be prosecuted on a large scale. It may be noted that this interest on the part of Liverpool business men still continues, for the Board of Messrs. John Holt & Company (Liverpool) Limited, anxious to do something to develop research in malaria, in 1948 provided £10,000 to be paid over the ensuing four years.

The London School of Tropical Medicine, now known as the London School of Hygiene and Tropical Medicine, incorporating the Ross Institute, was founded in 1899 a few months after the Liverpool School. In this case it was Sir Perceval Nairne of the Seamen's Hospital Society who took up the challenge and founded the School as a result of the public declarations of Sir Patrick Manson, more especially his address at St. George's Hospital in October 1897. These declarations were reinforced by the vigorous support of that far-seeing Colonial Secretary, Joseph Chamberlain. Some account of the founding of these two schools is given in their Annual Reports.<sup>1</sup> One year after the inauguration of the London School, Hamburg founded its Tropen Institut, which avoided one of the errors of the British schools in that a research institute and a hospital for tropical diseases were incorporated in the same building. It is scarcely too much to say that all the great advances of the past half century in tropical medicine have been due directly or indirectly to the inspiration of these three schools.

It is not uninteresting to look back on what has been accomplished in these fifty years. Following on the work of

Ross in malaria, Reed and his associates were able to prove Carlos Juan Finlay's theory of the mosquito transmission of yellow fever. This enabled Havana and Cuba to be freed from yellow fever and malaria, and the Panama Canal to be built by the American engineers where in the eighties of the last century the French had completely failed. Further studies of yellow fever provided a successful means of vaccination and fully elucidated its epidemiology and enzootology. There is now no further excuse for epidemics of yellow fever. New insecticides and antimalarial drugs have revolutionized the control of malaria. Typhus can be controlled by antibiotics and lice by insecticides. Methods for the control of trypanosomiasis have vastly improved. Penicillin and arsenicals provide a rapid means of treating yaws, and the former drug acts like a charm in tropical ulcer. There are now in fact methods for controlling all the more important parasitic diseases in the tropics and limiting their spread. Anyone who knows the tropics will be aware that there are still many problems to solve and that in many areas the standard of health among indigenous populations is deplorable. The next fifty years, however, should witness on a larger and ever more effective scale the application of methods already discovered. If parasitic diseases are to be limited and controlled, nutritional problems will become even more pressing than at present, for it is realized that multiple deficiencies due to lack of vitamins, amino-acids, and inorganic salts are rife in tropical countries and that already in many areas the population is pressing on the means of subsistence. It would be ludicrous, if it were not tragic, that people should be saved from death by parasitic disease only to die of malnutrition. The next half century must therefore see a revolution in the nutrition of tropical peoples. In this nutritional revolution students of tropical medicine will play an important and essential part, but if true health is to be attained their burden must increasingly be shared by veterinarians, agricultural experts, engineers and economists.

In the tropics the day of the medical man armed with a microscope, a box of slides, and a bottle of stain is now over. Henceforth only teams of experts can cope with the problems and eliminate disease. In the formation and guidance of these expert teams schools of tropical medicine will undoubtedly play an ever increasing part and will save them from many an error; as Goethe said, "there is nothing more terrible than ignorance in action."

\* \* \*

## 1492 Pathological Processes in Malaria and Blackwater Fever

Brian Maegraith. Oxford: Blackwell Scientific Publications, 1948. xi + 430 pages; 22 figures. 22 x 15 cm. £1 15s. [£1.75]

(i) Human malaria. Blackwater fever; (ii) the malaria parasite; (iii) the blood cells; (iv) the blood; (v) the liver: clinical evidence of hepatic dysfunction; (vi) the liver: pathology and pathogenesis; (vii) the kidney: clinical signs of dysfunction. Pathology; (viii) the kidney: pathogenesis; (ix) the brain; (x) the spleen and bone marrow; (xi) the adrenals and heart; (xii) pathological processes in malaria. References. Index.

Aeschylus was correct when he said that knowledge comes through suffering, for it has taken the sufferings of two world wars to bring home to western medical men the ravages of malaria, a disease which by a conservative estimate infects one in three of the population of the world. One sign of the renewed interest in malaria is this work, the first attempt to present a coherent picture of the basic physiological and pathological processes which determine the reactions of the animal body to invasion by the malaria

parasite. Although, owing to some of the appalling gaps in our knowledge, it has not been possible to arrive at anything like a complete account of malaria as a whole, certain processes have been found common to the development of lesions in all the organs; these processes are generalized anoxaemia, vascular endothelial damage, and general and local circulatory changes which result in the production of tissue anoxia. These lesions form, as it were, the leitmotif running through the whole book.

The opening chapter gives a brief account of the clinical manifestations of malaria and blackwater fever, together with notes on their diagnosis and treatment; treatment involves a consideration of the chemotherapeutic drugs now available. Although designed specially for those who are not familiar with malaria this succinct account will be read with profit by those who have already acquired a considerable knowledge of the subject. The parasites of human malaria are next described by Dr. R. H. Black, who has carried out much original work on the tissue culture of malarial plasmodia. In addition to the morphology of the parasites there are useful sections on their cultivation and metabolism. An all too brief section deals with the mode of action of antimalarial drugs.

As malarial parasites are most easily recognized when they attack the red blood cells it is appropriate that the action of malaria on the formed elements of the blood should first be considered: this is followed by a study of the biochemical changes in the blood, both in the uncomplicated malarial attack and in blackwater fever. The various organs are then systematically considered, anaemia being of special importance in the liver and kidneys. The theory which attributed the anaemia of blackwater fever to mechanical obstruction of the renal tubules here receives its quietus.

The pathology of the brain, spleen, bone marrow, and heart in malaria are then described and in a final chapter the pathological and biochemical changes are ably summarized. The section on immunity might well be expanded and a clear distinction drawn between tolerance and specific immunity. References are collected under chapter headings at the end of the book, which is beautifully produced on good paper and provided with an adequate index. As an attempt to weld together and to give logical form to what has hitherto been a somewhat inchoate mass of observations this clear and well-written book has an important service to perform. It should be read and thoroughly digested by all those to whom a clear conception of malaria is essential; and as malaria, with malnutrition and venereal disease, is one of the three greatest of medical problems, its readers should be numerous.

G. M. Findlay

#### 1493 Malaria Control by Coastal Swamp Drainage in West Africa

A. B. Gilroy. London: Ross Institute of Tropical Hygiene, The London School of Hygiene and Tropical Medicine (University of London) Incorporating the Ross Institute, 1948. viii + 97 pages; 10 figures; 22 plates; 3 maps. 22 x 14 cm.

(i) Introduction; (ii) details and practice of swamp drainage; (iii) the organization of a swamp drainage team; (iv) the financial aspects of swamp drainage; (v) legal aspects of swamp drainage; (vi) the maintenance of drained swamps.

One of the few advantages of war is that it allows sanitary works which have long been delayed because of governmental parsimony or procrastination to be undertaken and carried through to a successful conclusion. The malarious condition of Lagos, the capital of Nigeria, and of its wharves at Apapa, had long been an outstanding example of colonial maladministration. Early in the war it became obvious that if European troops, airmen, and sailors were to use the Lagos docks something must be done to reduce the appalling malaria rates which prevailed up till 1942. An extensive scheme was therefore begun to drain more than six square miles of swamps, lying within the urban district of Lagos, in order to eradicate the breeding places of the chief malaria vector *Anopheles melas*. The task was begun by the fighting Services and until 1944 the European staff of the team came entirely from the Army and the RAF. The continuation of the scheme then became a Government project financed from Colonial Development and Welfare Funds. None of the European staff had had previous experience of swamp drainage and very few of the African labourers knew even how to use a spade. In Dr. (then Lieutenant Colonel) Gilroy West Africa was, however, fortunate in obtaining the right man for the work, which despite the empirical approach was throughout based on careful calculations and controlled by scientific investigations. The conventional use of sea walls (bunds), drains and controlled outfalls had to be most carefully adapted to a very small tidal range and its efficacy in the control of anopheline breeding established. Some of the methods employed will undoubtedly appear unorthodox to engineers, while to medical authorities it came as a surprise that occasional ponding of drainage water could be used to so great an extent with impunity. Nevertheless, as the writer can testify from personal experience, these lapses from what was previously thought to be orthodox procedure were fully justified by admirable results.

In this short book Gilroy fully describes with wit and restraint the methods employed and the results achieved: what he does not mention are the tact and charm of the direction which enabled a large staff of Europeans and Africans to work together harmoniously under the most trying tropical conditions. Gilroy has here written a classic of malaria control and, as Sir Hubert Walker, Director of Public Works in Nigeria at the time, has said, "the value of the work to the war effort, the general health of Lagos and as a guide to similar work in future is incalculable."

G. M. Findlay

#### 1494 Trypanosomiasis in British West Africa

T. H. Davey. London: His Majesty's Stationery Office, 1948. 15 pages. 33 x 21 cm. 2s. [£0.1]

I. Extent of human trypanosomiasis in West Africa. II. The parasites responsible for the trypanosomiasis of man and stock in West Africa. III. Technique of diagnosis and methods of treatment. IV. The results of treatment. V. Methods of control of human trypanosomiasis. VI. The organization of sleeping sickness control in British West Africa. VII. Comments on the control of sleeping sickness in the Sudan and the foreign territories visited.

#### Trypanosomiasis in Eastern Africa, 1947

P. A. Buxton. London: His Majesty's Stationery Office, 1948. 44 pages. 33 x 21 cm. 3s. [£0.15]

A. Introduction. B. Current problems and research. C. Methods of reclamation from tsetse. D. Results of reclamation. E. Organization of research and reclamation. F. Summary.

#### The Anchau Rural Development and Settlement Scheme

T. A. M. Nash. London: His Majesty's Stationery Office, 1948. 22 pages; 4 plates; 10 figures. 33 x 21 cm. 3s. 6d. [£0.175]

(i) Introduction; (ii) an account of the initial work and preliminary investigations; (iii) building the villages; (iv) propaganda and upkeep of the villages; (v) the new town of Takalafiya; (vi) the new market for Anchau district; (vii) the improvement of old towns; (viii) the provision of fruit and shade trees; (ix) crops introduced or encouraged; (x) attempts to increase live stock and manure in the corridor; (xi) communal forest areas and forest reserves; (xii) education in the corridor; (xiii) anti-tsetse stream clearings; (xiv) the future of the corridor; (xv) suggestions from lessons we have learnt. Summary. Acknowledgments. References. Plates.

#### Tsetse Flies in British West Africa

T. A. M. Nash. London: His Majesty's Stationery Office, 1948. 77 pages; plates; maps. 33 x 21 cm. £1 10s. [£1.5]

Part I. Nigeria. Part II. The Gold Coast. Part III. Sierra Leone. Part IV. The Gambia. Part V. West Africa.

Although trypanosomiasis in Africa had been described in the 18th century it was not until after the First World War that its extent was fully recognized. It was then seen that the tsetse fly which bites man and his domestic animals indiscriminately was one of the greatest enemies to the progress of Africa south of the Sahara. Many panaceas have been offered for the eradication of the tsetse or, if that were not possible, for the elimination of trypanosomiasis in man and animals. Some have pinned their faith to shifting indigenous populations and their domestic animals to areas free from tsetse; others have believed that slaughtering all the big game in an area would eliminate infection; still others have favoured the clearing of bush and vegetation so that the breeding places of tsetse could be destroyed. A fourth group of experts has thought that mass diagnosis and treatment of all human patients would be sufficient. Each of these measures has produced good results in some areas but not in others, and in many areas trypanosomiasis has, if anything, appeared to be extending its boundaries. In Uganda, for instance, areas which some forty years ago maintained flourishing herds of cattle are now covered with impenetrable bush. The tsetse is an inveterate traveller and no one in Africa could have welcomed more enthusiastically the cessation of intertribal wars and the coming of the bicycle and the motor car.

Gradually, in the period between the wars, it became evident that the only hopes of success against trypanosomiasis lay in a combination of measures, coupled with a very intensive study of the breeding habits and general ecology of the different species of *Glossina*. Much knowledge was gained, especially by the work of the late C. F. M. Swynnerton, but the plans and activities of many of the African Colonies were seriously impeded by the economic blizzard of the early 1930's. With the ending of the Second World War and the passing of Colonial Welfare and Development Acts, new possibilities came to light in the application of the recently discovered insecticides and in chemoprophylaxis for man and animals.

In order to take stock of what has already been accomplished, four reports have been prepared for the Tsetse Fly and Trypanosomiasis Committee, appointed by the Secretary of State for the Colonies; they have been edited for publication by the staff of the Bureau of Hygiene and Tropical Medicine. Professor T. H. Davey's *Trypanosomiasis in British West Africa* and Professor P. A. Buxton's *Trypanosomiasis in Eastern Africa, 1947* are the results of



fact-finding tours. The former deals especially with the four British West African Colonies and more generally with the Anglo-Egyptian Sudan, French West and Equatorial Africa, the Belgian Congo, and Liberia. A useful, if rather superficial, summary of information on both human and cattle trypanosomiasis in these areas is given but it was obviously impossible for the author to cover so vast an area satisfactorily in the time at his disposal. In East Africa the problems differ very considerably from those in West Africa, for whereas in the latter region trypanosomiasis is conveyed directly from man to man by the bite of the tsetse, in the east human infection is closely interconnected with big game and the tsetse which associates with them, *Glossina morsitans*. Even more serious is the cattle problem, as wild game again constitutes the reservoir of infection for cattle trypanosomiasis, *G. pallipides* and *G. swynnertonii* acting as transmitters as well as *G. morsitans*. Up to the present it has had to be conceded that cattle and big game cannot exist together in the same area. How far spraying with DDT or gammexane will reduce the fly population, and how far chemoprophylaxis can be used, are now being investigated. The high hopes centred on antrycide are probably doomed to disappointment in view of the ease with which trypanosomes become resistant to this drug. Already in Tanganyika, by eradication of game and bush clearing, some 1,300 square miles have been reclaimed and now contain more than half a million head of cattle. In Southern Rhodesia, by the eradication of *G. morsitans*, from 300 to 350 farms, each of 3,000 acres, are being provided in the more elevated regions of this territory for cattle which previously would have died.

The two most interesting reports, however, are those by Dr. Nash, who has devoted so much time to the study and amelioration of trypanosomiasis in West Africa. In 1934 it was found that much of the Anchau district in the Zaria Province of Northern Nigeria was infected by *G. tachinoides* and that no less than one-third of the whole population had sleeping sickness. It was decided to construct a fly-free corridor and as a result of what has been called the Anchau Rural Development and Settlement Scheme an area of some 712 square miles has been completely cleared. The actual clearing was preceded by most careful survey work and in the carrying through of the scheme, which cost only £95,000, the Geological, Veterinary, and Forestry Departments of the Nigerian Government co-operated with the Medical Department. It is a great pity that the services of an anthropologist also were not enlisted, for the scheme has involved the resettlement of 13,000 people who were previously living in indescribable squalor. Not only have tsetse flies been eliminated but a model town has now been constructed; more than 18,500 fruit and shade trees have been planted and successful pig-breeding initiated. This report shows convincingly how the solution of a specific medical problem may be combined with the general amelioration of the African's standard of life.

Dr. Nash's other contribution on the tsetse flies of West Africa is a mine of information, illustrated by excellent maps, on the distribu-

tion of the various species in relation to rainfall and vegetation: it will long remain a standard work of reference. It is to be hoped that other African countries may produce similar reports, so that exact and comprehensive tsetse distribution maps can be made available and the trypanosomiasis problem, which is not limited by artificial political frontiers, can be viewed as a whole.

G. M. Findlay

#### 1495 A Handbook for the Identification of Insects of Medical Importance

John Smart. With chapters on fleas, by Karl Jordan and on arachnids, by R. J. Whittick. Second edition. London: printed by order of the Trustees of the British Museum, 1948. xi + 295 pages; 178 figures; 13 plates. 25 x 18 cm. £1

The species of protozoa and helminths which are of medical importance are not numerous and, with certain exceptions, are easily identified. The medically important arthropods, on the other hand, are relatively numerous, and in many instances their identification involves a more than rudimentary knowledge of their anatomy. The 1st edition of Dr. Smart's book, which was published in 1943 and which met with immediate and well-deserved success, had the avowed object of assisting the medical officer serving abroad to identify all the more important arthropods he was likely to encounter. To accomplish this formidable task in a reasonable space the author and his collaborators made but few references to the medical aspects of their subject and omitted, in most instances, any account of medically important arthropods occurring only in the New World. This latter omission was justified under wartime conditions, but when a 3rd edition of the book is called for, as the reviewer believes it will be, it is to be hoped that this omission will be remedied and that accounts of such medically important New World species as *Dermatobia hominis* will be included even at the cost of omitting some of the Old World species, such as *Hypoderma bovis*, which are of little medical significance.

The present edition has been lengthened by some 30 pages of text and contains a number of new illustrations. The section on tsetse flies has been extended and includes fresh information regarding the geographical distribution and breeding places of various species. Dr. Karl Jordan has rewritten and extended by some 11 pages the chapter on fleas, now named *Suctoria*. Dr. Kenneth Mellanby has revised Mr. R. J. Whittick's article on arachnids, and Mr. H. S. Leeson has contributed a new table showing the anopheline vectors of malaria, ranked in order of importance.

Economy of space and weight severely limits the number of books packed by the medical officer proceeding abroad. Nevertheless, he would be well advised to include a copy of "Smart" amongst the chosen few; nor need economy of cost deter him from the purchase, for, in these days of expensive editions, the present well-produced and well-illustrated work is cheap at 20 shillings.

R. M. Gordon

## SOCIAL MEDICINE

1496

### THE POPULATION PROBLEM

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The population problem is of special interest to the medical profession for several reasons. In the first place, the increase in numbers and the change in age-structure which have occurred have been due mainly to the progress of medical science. Again, productive efficiency is dependent, at least

in part, upon the standard of health; and it is productive efficiency which largely determines the maximum population which a country can support. Perhaps most important of all, the medical profession combines with specialized knowledge a peculiar intimacy with family affairs; it thus possesses in unusual degree the power to influence future population trends.

It should at the outset be clear that, apart from public-health measures, the role of the doctor is limited by the doctor-patient relationship. With national policy the doctor has no direct concern. In treating infertility he is correcting a pathological disorder; the State cannot employ him as a recruiting sergeant in the world of the unborn. Except in those cases where future pregnancies would be dangerous,



his advice on contraception is given only because of his knowledge of the physiological processes involved and in order to meet the wishes of his patients.

In the nineteenth century there was a rapid increase in population accompanied by a steady rise in the standard of living. At the same time new social classes were delineated, based on great inequalities in the distribution of wealth. There was poverty in the midst of plenty. The creation of a large family was generally found to be inconsistent with the attainment of a high standard of living. In the early decades of this century, therefore, the time was ripe for the widespread adoption of the techniques of birth control. Indeed, after the First World War the falling birth-rate caused concern lest British stock should fail to replace itself; the differential fertility among the social classes gave rise also to the fear that there would be a reduction in quality as well as in quantity.

In our own day, the planning of the Welfare State has further focused attention on population problems. The new humanitarianism decrees that the world's resources should be shared alike by all nations, irrespective of race, colour, and degree of social development. Two world wars and a major economic depression have led to a widespread feeling of insecurity. There is a demand by all for the luxuries previously enjoyed by a few, and a strong feeling that the risks of life must be shared by all classes alike. These factors, together with the political uncertainties of the future, underline the importance of the study of population trends.

In the last two years four important reports dealing with this subject have appeared. In April 1948 l'Alliance Nationale contre la Dépopulation held a three-day conference for the study of the ageing of the population. The published report<sup>1</sup> shows that the subject was treated exhaustively from every angle. The dangers in France are particularly acute because of the serious fall in the birth-rate and because of the presence on her eastern frontier of a traditional enemy of far more prolific habits. These dangers she attempts to counter by substantial inducements to parents and by large-scale immigration.

The Family Planning Association of Great Britain has published a report<sup>1</sup> on an International Congress on Population and World Resources in Relation to the Family, held at Cheltenham, England, in August 1948. Its cosmopolitan character compelled it to recognize the international point of view—the equalization of standards of living both as a matter of equity and as a means of inducing the more prolific races of the East to lower their birth-rates. The meeting was much influenced by the grave warning given by Lord Boyd-Orr and others of the risk of a world food shortage. The avoidance of disaster would depend upon the outcome of a race between diminishing food supplies and restriction in numbers. At the same time, the conference expressed concern at the fall in the population of Western Europe.

In 1948 also appeared *Population policy in Great Britain*,<sup>1</sup> a volume published by the organization known as P E P (a voluntary group concerned with political and economic planning). Finally, in June 1949 there was released the long-awaited Report<sup>1</sup> of the Royal Commission on Population. It is with these last two publications that we are chiefly concerned; the remarkable similarity in their points of view is noteworthy.

### Phases of Demographic Evolution

According to *Population policy in Great Britain*, the changes in population which civilization brings can be divided into three phases: (i) a phase of high and uncontrolled birth-rate, and similarly high death-rate, resulting in a stationary population; (ii) a fall in the death-rate causing an increase in the population and (iii) a later check in expansion caused by a fall in the birth-rate, with the result that the population then tends to become stationary or even to decline.

This scheme oversimplifies the picture; the five phases described by C. P. Blacker (1947) give a truer conception. These phases are (i) that of a stationary population, with high birth-rate and high death-rate; (ii) an expansion of the population, due to high birth-rate and low death-rate; (iii) the phase in which both birth-rate and death-rate decline, the latter more rapidly than the former, so that the population continues to increase though more slowly; (iv) the phase in which birth-rate and death-rate are equally low, so that the population is stationary and (v) a phase, which may or may not occur, in which an excess of deaths over births leads to a fall in the population. Blacker's fourth phase may with advantage be subdivided into (a) a period in which both birth-rate and death-rate are declining equally so that a stationary population results and (b) a period in which both birth-rate and death-rate are permanently low. While (a) may be temporary and unstable, (b) may be permanent and stable. Great Britain is now in the later stage of (iii) and will shortly enter upon phase (iv, a).

### Accuracy of Population Projections

In delineating future population trends there are so many imponderables that there must be some margin for error. For such projections to be of value, this margin must be small. It is interesting to compare the projections of the total population as given by the Royal Commission with those contained in *Population policy in Great Britain*. Since the former deals with the whole of Great Britain and the latter with England and Wales only, we must express the changes as percentages of the starting-points, making the reasonable assumption that the inclusion or exclusion of Scotland has no significant effect. The only difference, and that a minor one, between the assumptions on which these two projections are based, is that the Commission assumes a constant family-size as among couples married between 1927 and 1938, while the P E P projection adopts the 1938–1939 level. Table I shows that there is wide disagreement between the two projections.

When the figures of the Royal Commission are compared with those of Lord Beveridge's report on social insurance and allied services, published only seven years previously, the disagreement is just as marked. The Royal Commission gives three sets of figures based upon three different assumptions: assumption A, family-size at the same level as among couples married between 1927 and 1938; assumption B, family-size at a level 6% higher than A; assumption C, a fall of 20% in family-size on A (see Table II). The Beveridge Report figures for 1971 are compared with the Commission's figures for 1977 based on these assumptions.

<sup>1</sup> For particulars, see pages 274 & 275.

**TABLE I. A COMPARISON OF POPULATION PROJECTIONS**

Report of Royal Commission Projections assuming family-size constant at same level as among couples married 1927-1938 and with a continuance of declining mortality trends of recent years				PEP (Political and Economic Planning) Report Projection assuming fertility constant at 1938-1939 level, with mortality falling			
Year	Total population of Great Britain (millions)	Change from 1947		Year	Total population of England and Wales (millions)	Change from 1944	
		Millions	%			Millions	%
1947	48.2			1944	42.4		
1977	50.7	+2.5	+5.2	1974	41.1	-1.3	-3.1
2007	48.9	+0.7	+1.4	2004	35.2	-7.3	-17.2
2047	45.5	-2.7	-5.6	2044	28.0	-14.4	-33.9

The fact emerges that there is more difference between the projection of the Beveridge Report and those of the Commission than there is between the various projections made by the Commission based on widely varying assumptions. Both of these projections, however, are founded on the statistics of the Registrar-General. If the disparity is due to improvements in the methods of projection made in the past seven years, one wonders whether further improvements will result in further differences. And yet on such projections hang momentous consequences, e.g., the actuarial calculations of the National Health Service Act and the National Insurance

Act, 1946, and the population policy advocated by the Commission. Allowing for the differences in assumptions, these discrepancies rudely shake one's faith in the soundness of such calculations and the policies based on them. Recent experience would indicate that there is, in fact, no satisfactory way of selecting the group of assumptions most likely to prevail in the future.

#### Proposals of the Royal Commission

The Commission recommends a policy which would increase the total population by 1.8 millions in 1977, by 3.4 millions in 2007 and by 7.2 millions in 2047. This increase would be achieved by encouraging an increase in family-size from the present 2.2 children per family to the figure of 2.6. The means advised fall into two groups of measures: financial inducements to parents and the better conservation of life from the moment of conception. An annual expenditure of £37.5 millions more in increased children's allowances is advocated, together with a substantial reduction in income tax for parents in the higher income group.

These proposals raise many questions. If the Commission is right in believing that economic considerations are now the chief deterrents to large families, the proposals, in effect, remove or reduce the automatic check to a large population increase, namely, the demand for a higher standard of living. What guarantee have we that the removal of the deterrents will not result in the large increase in the population which the Commission emphatically and rightly considers undesirable? The special treatment of the higher income groups is unassailable on grounds of equity and justice, but the Commission gives no estimate of the cost nor does it tell us from what source the money is to be derived. This proposal will no doubt be strenuously resisted by that large body of opinion which believes that in the lower income groups there is a wealth of ability now lost to the community through financial stringency. One needs more information about the extent to which the upper income groups are continuously replenished from the lower.

The optimum population of this country is influenced by three factors: the world food-supplies, the balance of payments from foreign trade, and the cost of maintaining the population in the standard of living and state of health which it demands. If there is to be a food shortage of the magnitude predicted by many authorities, two or three million people more or less will make little difference. The Commission admits that there are many uncertainties in the future of foreign trade, but considers that a stable balance of payments at a slightly higher figure than the present is likely to obtain. This is a matter upon which only economists are competent to express opinions. But in the matter of the cost of maintaining the population in health, it seems that the Commission has not fully realized the significance of present trends, nor has it realized the aggravation of these trends which would without doubt ensue from its recommendations.

To consider first the ageing process of the population: by 1977 old age pensioners will have increased to 9.6 millions, or nearly 19% of the total population. In 1978 the cost of pensions alone will reach the figure of £501 millions. This must be borne entirely by the Exchequer, that is to say, by the working section of the population, whose numbers will meanwhile have undergone a considerable diminution. This

**TABLE II. PROJECTED POPULATION OF GREAT BRITAIN BY AGE GROUPS**

The projection in the Beveridge Report (1942) is compared with the three projections given in the Report of the Royal Commission. The estimates from the Beveridge Report are based on the assumptions as to fertility and mortality given in the White Paper on "Current Trends of Population in Great Britain". The Commission places women aged 60-64 in the workers' group, and estimates that the number of these will remain almost constant at 1.4 millions. An adjustment has therefore been made to make the two sets of figures comparable.

Age groups	Beveridge Report	Royal Commission		
	Year 1971 (millions)	Year 1977 (millions)		
		Assumption A	Assumption B	Assumption C
0-15	7.6	9.8	10.5	8.1
Men 15-64 Women 15-59	28.8	31.3	31.8	30.8
Men over 64 Women over 59	9.6	9.6	9.5	9.7
Total Population	46.0	50.7	51.8	48.6

sum is probably an underestimate; as the Commission admits, the number of pensioners will probably be much larger, owing to the advance of medical science. The Commission hopes that some relief of the financial burden will accrue from the improved health of the elderly and from prolongation of their capacity for work, though the frustrating effect of such a situation upon the young is recognized. Present trends in medicine, however, indicate that any economy from the increased working capacity of the old will be more than counterbalanced by the increased cost of their medical care. Medical progress is likely to result in slowing down without curing the degenerative processes which are the inevitable accompaniments of old age.

Numerous proposals are made by the Commission for the preservation of young life. There must be more domestic helps, nurseries, nursery-schools, sitters-in, better laundry facilities, and holidays for mothers. There must be more adequate treatment of involuntary childlessness and research into its causes, instruction in contraception, improved health and maternal services, a larger number of midwives, convalescent and rest homes for mothers and more education in child health. Many of these are in course of being provided by the National Health Service.

Though the Commission does not expressly subscribe to the optimistic hopes of the results of an improved health service entertained by the writers of the P E P report, it appears to think that prolongation of life is achieved by the simple process of medication. The truth is very different. In previous communications (Roberts, 1948, 1949) I have given abundant reasons for believing that the cost of the Health Service will exceed even the highest of the growing estimates. These reasons are, in brief, that the cost of medical care increases with a rising standard of living and also with an ageing population; that an extension of the Health Service involves a high capital expenditure in buildings and equipment; and that its cost will be further increased by the competition, pride in craftsmanship, and the desire of the medical profession for perfection.

Our understanding of disease is becoming ever more complex. Our ability to treat patients and to maintain them in subnormal health advances far more rapidly than our ability to cure them and keep them at work. We attack the gap between the vulnerability of the normal cell and the vulnerability of the causative agent of disease only under the most careful pilotage of expensive and elaborate laboratory tests. Contrary to the popular belief, the inevitable effect of medical progress is to increase the cost of ill-health.

Even more formidable than the cost in money is the cost in man-power. The Commission, in common with other planners, neglects to add up all its individual requirements. It admits that many of its proposals are long-term policy, but we are not told what is meant by "long". In man-power the future is menacing in the extreme. The future relation between workers and dependants calculated from the Commission's figures is shown in Table III.

It can be seen that the number of dependants per 100 workers will rise considerably if present population trends continue. This position, of course, will be materially worsened should the emigration of young workers continue or increase. If the Commission's assumption B is implemented, the rise in the number of dependants will be aggravated by 3.4% in 1962 and by a further 3.3% in 1977. Not

TABLE III. PROPORTION OF DEPENDANTS TO WORKERS

This table is derived from the population projections of the Royal Commission and shows the combined number of people over 65 and children under 15 (dependants) per hundred people aged 15-64 (workers).

Year	Assumption A		Assumption B		Assumption C	
	Number of dependants per 100 workers	Increase on 1947 (%)	Number of dependants per 100 workers	Increase on 1947 (%)	Number of dependants per 100 workers	Increase on 1947 (%)
1947	47.0	—	47.0	—	47.0	—
1962	50.0	6.4	51.6	9.8	49.0	4.3
1977	54.4	15.9	56.0	19.2	50.9	8.3
2007	53.8	14.5	54.0	14.9	50.9	8.3
2047	56.9	21.6	56.8	20.8	57.4	21.3

until 2007 would there cease to be any difference between figures based on assumption A and figures based on assumption B. Until we know the effect of the medical and social plans now coming into operation, is it wise to aggravate the burden by financial inducements to greater procreation?

### Conclusions

We all desire long life as well as prosperity. Increased expectation of life is a component of a rise in the standard of living. The standard of living, then, includes medical care of all sorts. The provision of medical care is becoming increasingly expensive, and the time must come when its cost must conflict with the enjoyment of the amenities and luxuries of life—alcohol, tobacco, entertainment, and shorter working hours. Indeed, we shall be fortunate if it does not conflict with the provision of the bare necessities of life.

We may classify the factors involved into uncertainties, probabilities, and certainties. The future of world food-supplies, the balance of payments from foreign trade and the validity of official population projections are uncertainties. The probabilities are that food-supplies and balance of payments will deteriorate. The certainties are that in the next thirty years the shortage of man-power will be greatly aggravated, and that the cost of the health and social services will rise to such an extent that it will constitute a menace to our export trade upon which depends our standard of living. In view of all this, one is forced to the conclusion that, unless we are prepared to adopt a lower standard of living, a policy of increasing the population by financial inducements should not be undertaken.

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## 1497 The National Health Service

Charles Hill & John Woodcock. London: Christopher Johnson, 1949. clx + 283 pages. 19 x 13 cm. 16s. [£0.8]

(i) Introduction. Hospital and specialist services. (ii) The general hospital plan; (iii) the administrative structure; (iv) terms and conditions of service for specialists; (v) private accommodation and fees: some other points. General medical services. (vi) General features; (vii) compensation; (viii) regulations; (ix) certification; (x) maternity services; (xi) remuneration; (xii) disciplinary procedure and investigation of complaints; (xiii) supplementary ophthalmic services. Other services. (xiv) General dental services; (xv) pharmaceutical services; (xvi) health services provided by local health authorities; (xvii) mental health services; (xviii) superannuation; (xix) transfer and compensation of officers. Addenda. (xx) The Amending Bill; (xxi) other matters. Appendices. Index.

As the State spreads its controls ever wider it becomes increasingly difficult for the individual citizen to appreciate how he or she is affected by new legislation. When in addition, as has been cogently pointed out more than once by the judiciary, some modern Acts of Parliament are so drafted that their exact meaning may be incomprehensible even to the trained legal mind, there is little encouragement for the average individual to try and find out precisely what are his rights and duties. In the case of the National Health Service Act, however, the issues involved are so vital to the individual that it is incumbent that, whether doctor or layman, he should be made conversant with exactly what is involved. In spite of the publicity the Service has received, little of an informative or explanatory nature has been published hitherto. Government pamphlets have either been so simplified as to be of little value or have dealt only with particular aspects of the Service.

It has been left to the versatile Secretary of the British Medical Association, in collaboration with a colleague, to provide the first authoritative and comprehensive explanation of the working of the Act. In clear, concise, non-technical language they have provided a running commentary on the Act which could scarcely be bettered. One of its great values is that it is not a mere paraphrase. Drawing upon his unrivalled experience acquired in the prolonged negotiations preceding the introduction of the Service, the senior author has not hesitated to stress when necessary what the Act does *not* say as well as what it does say, and to point out on occasions the full implications of certain sections of the Act. For instance, after noting that the Minister of Health cannot acquire, except by purchase or gift, any new hospital or nursing home that anyone may establish in the future, it is pointed out that he has the power to acquire by compulsion, if necessary, any land required by him for the purposes of the Act and, to quote the authors, "legally speaking—land includes any building on that land."

There will be few who will not learn something from a perusal of this book. How many people, to take two examples, are aware that the certificate of a private practitioner enables a private patient to draw his cash benefits under the National Insurance Act, and that an individual can "obtain his general practitioner service privately without losing the right to obtain his specialist service at the public expense"? It is in this precise interpretative manner that the whole Act is analyzed, and the book is completed by a valuable set of appendices, giving details concerning membership of regional hospital boards, travelling allowances, pay-bed accommodation, and so forth. In view of the delays in publication in this country, the book is amazingly up to date, and in this alone reflects credit both on the authors and the publishers. This is a book which can justifiably be called "invaluable" for all members of the medical profession and all laymen who are concerned with the working of the National Health Service. It can also be recommended to the ordinary citizen who wishes to have a reliable idea of how the Service works. In addition, it can be recommended without reservation to the foreign observer who wishes to cut through the maze of inexact information with which the Service has been noised abroad, and learn the anatomical details of the structure of the National Health Service. The book makes no attempt to deal with the functioning of the Act; it is, therefore, no criticism to say that for a study of function, as opposed to design, the observer will need to turn elsewhere. The answer to the age-long question, "Can these bones live?", will not be found here. This is a work which deals with facts—not with the future.

W. A. R. Thomson

## 1498 The National Health Service Act, 1946: Annotated Together with Various Orders and Regulations Made Thereunder

S. R. Speller. London: H. K. Lewis & Co. Ltd., 1948. xc + 497 pages. 22 x 14 cm. £2 2s. [£2.1]

The National Health Service Act, 1946: arrangement of sections. (i) Central administration; (ii) hospital and specialist services; (iii) health services provided by local health authorities; (iv) general medical and dental services, pharmaceutical services and supplementary ophthalmic services; (v) special provisions as to mental health services; (vi) general. Schedules. Statutory instruments. Index. Supplementary index.

This important book is primarily for the administrator of public services in Great Britain. It is an essential desk companion for any one whose work involves an exact knowledge of health services legislation.

The National Health Service Act, 1946, which came into force in July 1948, affects the majority of the country's medical and ancillary services and in many parts of these it makes fundamental changes. The Act did not prescribe the detail of these changes; it set out the principles to be followed and established the administrative machinery, leaving details to be laid down in Regulations to be made by the Minister of Health, usually after consultation with the interests involved. It was clear that the Regulations would be voluminous, and indeed, even before the Act came into force, they far exceeded the Act in bulk. Inevitably some Regulations are amended in important respects by later Regulations. It is difficult to keep abreast of this growing and changing legislation and those who must do so owe a debt of gratitude to Mr. Speller.

The first part of the book is a reprint of the Act with brief, lucid, and practical comments. The comments are printed immediately below the section or subsection to which they refer and are of various kinds, e.g., reference to other relevant sections of the Act and title of Statutory Rules and Orders and Statutory Instruments made under the section, legal implications of the sections, and lastly a reference to section 79 of the Act for all words defined in the Act. This oft repeated reminder is of great value, for many everyday words bear special meanings in the Act. Thus "hospital" has a much wider meaning than in general parlance. It includes, for example, tuberculosis clinics and venereal diseases clinics, even where these are separate and independent units. It is easy, in reading the legislation, to lose sight of the extended meaning, and the discreet note "For definition of 'hospital' see s. 79" and similar reminders are most useful. Similarly, the references to other relevant sections and to Regulations are great helps to accuracy in interpreting the law. They lead the reader directly to the information he requires without the need of lengthy searching through the legislation.

After the text of the Act follow the Statutory Rules and Orders and Statutory Instruments made under it. These are given separately in chronological order. Subsequent amendments, deletions and additions are marked by marginal notes giving reference to the latest Regulations. Regulations issued too late for inclusion in the book appear in chronological order in a supplementary index. This quotes full titles of Regulations and gives a brief summary of the subject-matter of each. A good general index covers all parts of the book except, of course, the supplementary index of Regulations.

The flow of Regulations continues and is likely to continue for some time to come, for the Health Services are still evolving. Hence "Speller" was, as the author points out in his preface, already to some extent out of date before publication. This inevitable shortcoming does not greatly detract from the book's value; it is no small advantage to have so wise a guide through almost five hundred pages of legislation.

D. B. Bradshaw

## 1499 Introduction to Public Health Law

John J. Clarke. London: Cleaver-Hume Press Ltd., 1949. 138 pages. 22 x 14 cm. 12s. 6d. [£0.625]

(i) Introduction; (ii) the administrative framework; (iii) the legal system and local authorities; (iv) the Public Health Act, 1936, and its local administration; (v) sewerage and sewage disposal; (vi) private sewers, drains and sanitary conveniences; (vii) provisions and by-laws with respect to buildings; (viii) removal of refuse and cleansing; (ix) nuisances and offensive trades; (x) provisions concerning water supply; (xi) the Water Act, 1945; (xii) prevention, notification and treatment of disease; (xiii) baths, washhouses, common lodging houses, canal boats, etc.; (xiv) the Food and Drugs Act, 1938; (xv) cognate powers and functions; (xvi) notification of births, maternity, child welfare;

(xvii) the National Health Service Act, 1946. Appendix: a century of public health legislation. Short bibliography. Index to statutes. Index to cases. General index.

Mr. J. J. Clarke has made many contributions to setting out clearly the law relating to social administration. This is a small book compared with such immense volumes as his well-known *Social administration, including the Poor Law*, but it has the same characteristic judicious choice of really important subject-matter and accuracy of fact and reference.

After a short historical introduction, essential always to the understanding of British institutions and customs, the administrative local bodies and their functions are described with the assistance of reference tables. There follows a chapter on the legal system and the way in which the judicial and administrative functions of statute law relating to public health and other social services are divided between the judicial authorities and the local councils. There is a particularly clear section on the liabilities of authorities and their members for their actions.

In 1936 the law on public health was codified and amended, and the Public Health Act of that year, although much amended by post-war legislation, still contains the main body of the public health law of England. In a series of chapters this Act is examined in detail, and commentaries on interpretations and legal decisions resulting from judicial interpretations in disputes are set out in each section. In this way the volume provides a useful introduction in method to the student who later may have occasion to consult one of the larger legal textbooks.

Other important acts, such as the Water Act, 1945, and the Food and Drugs Act, 1938, are treated in similar fashion. Finally, the National Health Service Act, 1946, is described, particularly in relation to the changes resulting in public health law and practice.

This book can be recommended strongly as an introduction to its subject or as a handbook for rapid reference which will often save much searching in more bulky volumes.

Alan Carruth Stevenson

## 1500 Modern Trends in Public Health

Edited by Arthur Massey. London: Butterworth & Co. Ltd., 1949. xi + 581 pages; 42 figures. 25 × 17 cm. £2 10s. [£2.5]

(i) The idea of a family health club; (ii) nutrition and the public health; (iii) social medicine as an academic discipline; (iv) recent laboratory contributions to epidemiology; (v) general practice and its contribution to preventive medicine; (vi) the future scope of infectious diseases hospitals and associated services; (vii) the combat with atmospheric pollution; (viii) public health nursing; (ix) chronic rheumatism as a public health problem; (x) occupational health and the universities; (xi) the contribution of dentistry to the public health; (xii) housing and the home—the new outlook; (xiii) school health service; (xiv) the mental health aspect of public health; (xv) health centres in their relation to social medicine and public health; (xvi) child health and the universities; (xvii) day nurse developments; (xviii) health centres; (xix) laboratory services. Index.

It is always a pleasure to see a new volume in the Modern Trends Series of Butterworth's medical publications and *Modern trends in public health* is a well-written, well-printed and well-produced addition. The names of the 23 contributors command respect and assure the reader of authoritative guidance in each chapter.

New ground is broken by K. E. Barlow in his discussion of the idea of a family health club. Barlow has been a most prominent follower of Scott Williamson of the Peckham Pioneer Health Centre, of which he is now the deputy director. Fraser Brockington follows with an exceedingly well-informed survey of nutrition and the public health; this section is the fruit of special study. F. A. E. Crew brings new light on the idea of social medicine; a fine historical undercurrent runs throughout the chapter. R. Cruickshank gives a clear picture (as can be expected from his pen) of the subject of epidemiology. This section not only makes good reading but is a mine of practical help.

In a well-written chapter dealing with general practice and preventive medicine there is evidence of the new outlook of the general practitioner on public health. More formal subjects such as atmospheric pollution, infectious diseases hospitals, and public health nursing, are adequately dealt with. The sections "Housing and the home" (J. M. Mackintosh), "School health service" (A. A. E. Newth), "Health centres in their relation to social medicine and public health" (R. H. Parry), "Health education" (R. Sutherland), "Health control at the ports" (H. C. M. Williams), "The new organization of public health laboratory services" (G. S.

Wilson), "Day nurseries" (H. Paul), all bear the stamp of first-hand and first-class knowledge.

This is a fine book and represents British public health practice at its best.

J. Burn

## 1501 Measurements of the Public Health. Essays on Social Medicine

F. A. E. Crew. Edinburgh: Oliver & Boyd, 1948. xix + 243 pages; 57 figures. 22 × 14 cm. 18s. [£0.9]

(i) Population; (ii) birth and fertility-rates; (iii) illegitimacy; (iv) multiple births; (v) the sex-ratio; (vi) marriage; (vii) the biology of death; (viii) stillbirth, infant mortality and maternal mortality. Definitions. Index.

Since the days of Graunt the interpretation of vital statistics has been to many people a fascinating study and has led to the discovery of strange and romantic facts that have had an important bearing upon the welfare of mankind.

Professor Crew has made splendid use of the material copiously provided by the Registrar-General for Scotland in producing a work which will be of value not only as a textbook but as a stimulus to anyone interested in the deductions which may be drawn from the trends and constitution of the population. He mentions the strange paradox that "War loosens the structure of society, weakens conventions and lowers standards. At the same time war and its inevitable concomitants focus enlightened public opinion upon problems of vast social importance and create a widespread demand for their solution." Certainly a realization of the significance of and the responsibility for an ageing population in the modern world has come as almost a shock to a post-war people and has led to the starting of many schemes for the welfare of the aged as well as to the appearance of a certain apprehension at the continuation of compulsory retirement at what is now coming to be regarded as a comparatively early age. A declining birth-rate and an increase in the school-leaving age may well mean that the maintenance and care of both young and old will throw an insupportable burden upon the working section of the population. The increasing interest in social medicine is, moreover, a sign of a healthy re-orientation of medicine away from the laboratory—whose failure to solve, or even to appreciate, some of the wider problems with which man is faced was beginning to be obvious—back to the study of the patient as an individual and of his surroundings. No matter how great a knowledge of bacteriological technique is available to Mrs. Jones and her advisers, it will but little avail her if her home remains insanitary and her water supply polluted by her neighbours' sewage. Many of the more important and essential facts of environmental hygiene have been accepted, and even if some of them are from time to time in danger of being forgotten in a welter of jargon, yet they are established and recognized. It is with the extension of environmental hygiene, under the austere and rather terrifying name of social medicine, that the modern worker is interested, and of which Professor Crew gives so fascinating an introduction.

Scotland, with a total population of just over 5,000,000, forms a convenient unit for a demographic survey, and many significant facts emerge. For example, it is of considerable importance to know that in 1945 the birth-rate was 16.86 per 1,000 of the population, the lowest ever recorded, but that this, being paralleled by a death-rate of 13.20, allowed for an over-all increase of population, although at the expense of the lower age-groups. From a detailed consideration of the birth-rate of other countries, it is clear that in Europe there is a general decline compared with India, China and the USSR, and that the fall in the European rate has been contemporaneous with the increasing industrial development of the Continent. It seems likely that such an association will continue to exist and will, in time, affect those countries that have not hitherto shared in the doubtful advantages of industrial progress.

Professor Crew's sensible pages on marriage and on death should be widely read, for they are the fruit of considerable thought and of a mature wisdom. His remark that "To the social biologist marriage possesses a special interest for the reason that its frequency and durability constitute delicate and fairly accurate measures of the healthiness or otherwise of the community" should give food for thought to those who tend to decry the value of marriage as a social institution. While discussing marriage Professor Crew manages to find strange facts among various national figures, and it comes as a surprise to read of the low marriage rate in the Catholic countries of Spain, Portugal and Eire, while the figures for the slow



and steady increase of non-ecclesiastical marriages in Scotland, from 11.85 per cent in 1940 to 14.1 per cent in 1945, fit in well with the progressive emptying of the churches in that country. But whether the deduction that the influence of the Church is stronger in the country than in the town, because there is a higher percentage of ecclesiastical marriages in the country than in the town, can be maintained is more doubtful—the absence of convenient register offices in country districts may have something to do with it.

It is difficult to decide when to stop quoting from Professor Crew's luminous deductions. In the increasing proportion of widowers who remarry he sees an indication of housekeeping difficulties and of the lack of domestic help. He pertinently remarks, also, that although we know that heart disease is the commonest cause of death the student of social medicine wants to find out what was the cause of the disease of the heart. The knowledge that the steady increase in the total number of deaths from cancer, without a corresponding rise in the standardized death-rate, is to be expected among a population with an ever-increasing number of people reaching the "cancer age", and does not necessarily mean an increase in the causes of cancer, is a comforting reflection, though not conducive to idle complacency.

Professor Crew has produced a valuable introduction to the statistical method which will be of use both to the uninitiated student and to those who have already experienced the delight and fascination of the study of figures. He guides well and surely. With gentle wit and irony he points out the many pitfalls and fallacies that beset the path of anyone searching for the truth of figures.

Amulree

## 1502 Text-Book of Public Health

W. M. Frazer & C. O. Stallybrass. Twelfth edition. Edinburgh: E. & S. Livingstone Ltd., 1948. ix + 571 pages; 78 illustrations. 22 x 15 cm. £1 10s. [£1.5]

(i) Introduction: public health administration; (ii) meteorology; (iii) lighting, ventilation, and warming; (iv) atmospheric pollution and smoke abatement; (v) water; (vi) drainage; (vii) sewerage and sewage disposal; disposal of refuse; (viii) housing and town planning; disinfection; (ix) occupational hygiene; (x) port health administration; (xi) nutrition: food inspection; (xii) vital statistics; (xiii) epidemiology; (xiv) infective diseases: disinfection; (xv) venereal diseases; (xvi) tuberculosis; (xvii) maternity and child welfare; (xviii) the School Medical Service; (xix) genetics; (xx) mental hygiene; (xxi) the welfare of the blind; (xxii) hospital administration; (xxiii) the social services. Appendix. Index.

The new edition of this old friend is a disappointment. It is clear that a textbook on public health published in 1948 would be outdated on publication by much important new legislation, but more should have been done to bring it up to date. Although the National Health Service Act did not become operative until 1948, it became law in 1946 and there was, therefore, time for revision in the light of its provisions. The Act is referred to in Chapter I, "Public health administration", and again in Chapter XXII, "Hospital administration", but its importance is not made clear. We might reasonably have expected many parts of the book to have been rewritten in conformity with the new Act, but this has not been done. The occasional footnote reference to the National Health Service Act is not enough. To quote just three examples, important parts of the sections dealing with hospitals, venereal disease services, and tuberculosis services are misleading as they stand.

The authors say that they have found "... no need to alter, in any material way, the more purely scientific parts of the book." With this opinion we disagree. The technical side of the book is in many respects in need of revision. Brief notes on air bacteriology and air disinfection are to be found in different chapters. These need to be brought together and considerably expanded. Be it admitted that this field is very imperfectly explored and that findings are still somewhat tentative; there is nevertheless a useful body of information upon these topics which should find mention. It is not unlikely that the next important advance in disease prevention will be made in this field and its importance should be made clear. It is surprising to find no reference in the section on smoke pollution to the estimation of sulphur dioxide in air. This is now a routine investigation and yields results of value. The section dealing with food control contains no reference to ice-cream. This is a serious omission. Ice-cream is now an important article of diet and local authorities are required to supervise manufacture and distribution. The section on food poisoning needs revision. "Outbreaks due to *staphylococci* are not infrequent" is the only information given on the important role of the staphy-

lococcus in this condition. This is not an adequate summary of present knowledge.

The tables illustrating the chapter, "Vital statistics", would be much more interesting if brought up to date, as they could be without difficulty. A table giving no information later than 1942 (Table xxii, p. 275) can scarcely be accepted as representative of "the last 40 years." The same criticism applies to some of the material in the section on maternity and child welfare. The paragraph dealing with neonatal mortality is so out of date as to mislead. It implies that England has not yet brought the rate down to 30 per 1,000 births. In fact the rate has been below 30 ever since 1937, falling progressively to 24.46 in 1946.

It would not be difficult to add to these points of criticism, but enough has been said to make it clear that the next edition of this book must undergo extensive revision if it is to regain the place of honour it has held in the past.

## 1503 Public Health Administration in the United States

Wilson G. Smillie. Third edition. New York: The Macmillan Co., 1947. xx + 637 pages; 43 figures. 24 x 16 cm. £1 12s. 6d. [£1.625]

Part I. (i) Functions of a health organization; (ii) development of public health administration in the United States. Part II. Administrative control of communicable diseases. (iii) Administrative principles of communicable disease control; (iv) administrative methods in control of diphtheria; (v) administrative control of streptococcal infection—respiratory; (vi) other communicable diseases of childhood; (vii) administrative control of typhoid fever and allied diseases; (viii) administrative methods in control of tuberculosis; (ix) venereal disease control; (x) acute respiratory infections; (xi) administrative control of smallpox; (xii) malaria; (xiii) rabies; (xiv) poliomyelitis; (xv) meningococcus meningitis; (xvi) intestinal parasites; (xvii) a miscellaneous group of diseases of public health importance. Part III. Basic activities of a health organization. (xviii) Vital statistics; (xix) epidemiology; (xx) the public health laboratory; (xxi) public health nursing; (xxii) sanitation and sanitary inspection; (xxiii) child hygiene; (xxiv) public health education; (xxv) mental hygiene; (xxvi) industrial hygiene; (xxvii) nutrition; (xxviii) adult hygiene. Part IV. Organization of public health programs. (xxix) Municipal health administration; (xxx) rural health administration; (xxxi) state health administration; (xxxii) health administration in the Federal Government; (xxxiii) voluntary health organizations; (xxxiv) disaster relief. The Red Cross; (xxxv) the practicing physician and the public health department; (xxxvi) training of public health personnel; (xxxvii) budgets and budget making; (xxxviii) the national health program. Appendix. Index.

This comprehensive book is partly a textbook for the practising public-health officer, partly a general survey of current public-health practice in the USA and partly a critical and forward-looking work which frankly acknowledges faults and urges progress. Anyone, whether doctor or layman, who is curious about American public-health practice will find the information for which he is looking, but it is no reflection on the author to say that the British health officer who reads the book will learn rather by negative than by positive information, for the over-all picture is one of abounding ambition tempered by certain features of social structure which seriously impede what Britain has learnt to call public-health progress.

Dr. Smillie, for instance, is presumably reflecting current American practice and opinion when he regards the activities of the infant welfare clinic, as it is known in Britain, as not really the function of the health department. The health department's job is considered almost entirely educative and even the type of general activity which he calls the "well child clinic" is to him a matter for the general practitioner; the health department should provide only for those who cannot afford a "family doctor". He is content with a total of three full medical examinations during the child's school life and suggests that more frequent inspections are unnecessary, in interesting contrast to the British aim of increasing the frequency of inspection. It would certainly seem from what he says that the USA draws too strict and arbitrary a line between the preventive and the curative. The British idea, that the "normal" is a field with wide limits and that the care of the child in the shadowy zone between the normal and the obviously ill, as well as the positive building of the fair or good into the better, is a medical specialty in its own right, is apparently not yet accepted in America.

Though a public health medical service is not acceptable to the USA, a nursing service rouses less objection. Dr. Smillie is able to think in terms of one nurse to every 5,000 of the population for duties comparable to those of the British health visitor, or one to every 2,000 if the duties include also what Britain calls "district nursing". He thinks in terms of a health education service far

more highly developed than the British one, and of educators far more ambitiously trained. Appendices to the book, in fact, dealing with the training of all public-health staffs, suggest standards higher than any country at present demands.

The peculiar local government structure of the USA has had its own limiting effect on public-health legislation and sanitary practice, but here and there an attractive virtue has grown from a necessity. More than would many English writers, Dr. Smillie sees the value and stresses the need of understanding co-operation between the health department and the general practitioner. He is impressed by the advisory committees of people active in the social life of the community, which are a common feature of health work in the smaller areas. He sees important virtues in the small, intimate, "county" health unit for the rural and semi-rural area. In fact, the fullness and candour of this account of one country's efforts to deal with public health make the book one which can be useful to public-health officers anywhere at the present time.

J. D. Kershaw

### 1504 Forensic Medicine: a Textbook for Students and Practitioners

Sydney Smith & Frederick Smith Fiddes. Ninth edition. London: J. & A. Churchill Ltd., 1949. xii + 659 pages; 173 figures. 22 x 14 cm. £1 10s. [£1.5]

(i) Legal procedure in England, Scotland and Ireland; (ii) the signs of death and subsequent phenomena; (iii) sudden death from natural causes. Presumption of death and survivorship; (iv) post-mortem examination of the body. Exhumations, Embalming, Cremation; (v) identification; (vi) wounds; (vii) injuries in various parts of the body; (viii) self-inflicted wounds and fabrications; (ix) wounds from firearms; (x) differential diagnosis in states of insensibility; (xi) examination of blood stains; (xii) injuries from burns and scalds. Corrosive fluids. Spontaneous combustion. Injuries from electric current. From heat. Cold. Starvation and neglect; (xiv) asphyxia from breathing irrespirable air; (xv) rape and indecent offences; (xvi) forms of pregnancy. Birth in its civil and medical aspects; (xvii) infanticide; (xviii) abortion. Responsibility. Lunacy certification; (xxii) toxicology; (xxiii) corrosive poisons; (xxiv) metallic poisons; (xxv) common hypnotics, antipyretics and anaesthetics; (xxvi) vegetable poisons; (xxvii) miscellaneous poisons; (xxviii) food poisoning. Cadaveric alkaloids. Appendix I: systematic analysis of the viscera for poisons. Appendix II: preservation of specimens. Appendix III: weights and measurements of organs. Composition of normal blood and normal urine. Appendix IV: forensic medicine in the East. Index.

This well-established standard work on legal medicine and toxicology has achieved for the Edinburgh School—and for Sydney Smith in particular—a world-wide repute. This 9th edition has received considerable revision in textual matter, notably in the section on blood-grouping, and contains many references to significant contributions to the subject in the last five years—Holbourn's work on head injury, Szent-Györgyi's contribution to

the study of muscle contraction, Shapiro's observations on foetal lung microscopy, Peters' and his collaborators' on BAL therapy and the like. It is a remarkable book, varying little from section to section in the authority and vision of its text, though covering the whole field—even including an appendix on analytical methods. A joint authorship has the advantage of relieving the original author of much routine reading whilst retaining the flavour of his writing and his sage evaluation of contemporary work: Fiddes has an important task and, on his first showing, has discharged it with no small success. The book needs no new recommendation to its vast public.

Keith Simpson

### 1505 Social Biology and Welfare

Sybil Neville-Rolfe. Chapter VIII contributed by A. E. W. McLachlan, together with a Handbook-Appendix on Social Problems, edited by Ethel Grant. London: George Allen & Unwin Ltd., 1949. 416 pages. 22 x 14 cm. £1 1s. [£1.05]

(i) Social biology; (ii) values; (iii) the individual; (iv) age cycle and behaviour pattern; (v) sex behaviour; (vi) family relationships; (vii) prostitution; (viii) venereal diseases; (ix) health and behaviour; (x) social work in the Colonial Empire; (xi) current problems of social hygiene. Handbook appendix on social problems. Index.

The attitude of society towards prostitution, venereal disease, illegitimacy and similar problems has profoundly changed in the past three or four decades; these problems are now dealt with in a more realistic way, and with, one feels, considerably more success in minimizing and repairing the harm done to the persons involved. Few have done more to bring about this change than Sybil Neville-Rolfe, who has been actively engaged in the study of these questions since before the First World War. Through her work on the British Social Hygiene Council, the National Council for the Unmarried Mother and her Child, and the Eugenics Society, she has played an important part in changing public opinion and in bringing about practical schemes to deal with these problems. Her work has extended beyond Britain into colonial and international spheres.

This volume presents an immense mass of data and information about conditions and developments throughout the world. There is an interesting autobiographical note about the author. Unfortunately, the book is not well organized; there is a lack of continuity and it is difficult to find any given topic without prolonged search. It is not an easy book to read because of the frequent change of subject, and it is not free from factual error, as on page 262 where Montreal and Quebec are referred to as French-Canadian provinces. Non-medical readers should find of value the chapter on venereal diseases. The book should be of interest to social workers and others whose professional life brings them into contact with these problems.

D. F.

## MEDICAL SCIENCES AND RESEARCH

1506

### CHEMISTRY OF PENICILLIN

JAMES WALKER Ph.D. D.Phil. D.Sc.

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When crude preparations of penicillin became available at Oxford, the chemical study of this powerful chemotherapeutic agent began long before it had been isolated as a homogeneous substance, the risk being accepted that substances identifiable as the result of degradative changes might originate from impurities rather than from penicillin itself. Preliminary work in Sir Howard Florey's laboratory showed penicillin to be an

acid, and a barium salt was prepared in 1941 by Dr. E. B. Chain, the process being improved later in collaboration with Dr. E. P. Abraham. Abraham and Chain were then joined in the chemical work by Sir Robert Robinson and Dr. Wilson Baker, conveniently located in the nearby Dyson Perrins Laboratory, and a provisional, but incorrect, molecular formula for the barium salt was soon suggested. Hydrolysis was also shown to yield carbon dioxide, a volatile acid, and the crystalline salt of a base. Interest in penicillin increased and the study of its chemistry was taken up in other laboratories. At the Imperial College of Science a concentrate was shown to give, on degradation, what was taken to be an amino-acid, while, in the United States of America, a crude ammonium salt was isolated. These observations comprised the whole of the information disclosed up to the end of 1942.

Early in 1943 a report from the Wellcome Laboratories in Great Britain described the conversion of penicillin by acid into a crystalline substance called penicillic acid, and American workers prepared esters of penicillin, which were more stable than salts, by the action of diazoalkanes. By this time the great therapeutic value of penicillin had become apparent and its potential military importance for the quick return of casualties to active service was fully appreciated. The publication of chemical information was then suspended entirely although reports on the chemotherapeutic applications of penicillin continued to appear from time to time. That information on the medical aspects was relatively unrestricted was doubtless sound psychology as well as a requirement of medical ethics, for it helped to build up the public consciousness of the powerful tool which was in the possession of the Allies but not available to the enemy.

### Anglo-American Collaboration

Unremitting work on the chemistry of penicillin went on and, in Great Britain, the Therapeutic Research Corporation became interested in the production and chemistry of penicillin. The progress reports rendered to the Penicillin Subcommittee of its Research Panel were known as the "PEN" reports, and the chemical information contained in them was privately communicated to recognized workers in the field. When the Ministry of Supply formed a General Penicillin Committee in October 1942 other interested groups were included, notably Imperial Chemical (Pharmaceuticals) Ltd., and an unofficial Conference of Chemists continued the handling of information on the chemistry and structure of penicillin. In the meantime, following the visit to the USA of Sir Howard Florey and Dr. N. G. Heatley in 1941, certain American pharmaceutical houses had become interested in the production of penicillin, and the information secured by these firms was communicated to the Committee on Medical Research of the Office of Scientific Research and Development and transmitted by it, via the Medical Research Council, to the Therapeutic Research Corporation, Imperial Chemical (Pharmaceuticals), and the various academic groups in Britain. In the autumn of 1943, when many of the structural features of the penicillin molecule had emerged and large-scale production had not yet been satisfactorily achieved, the problem of possible synthesis became a pressing one, and the Medical Research Council set up a Committee for Penicillin Synthesis "to initiate, coordinate and make investigations on the synthesis of penicillin and analogues"; the confidential reports which were issued and exchanged were known as the "CPS" reports. At the same time, the Committee on Medical Research, having undertaken the co-ordination of chemical work on penicillin in the USA, agreed to exchange with the Medical Research Council information on anything having a bearing on the problem of the synthesis of penicillin, and a group of industrial and academic research organizations collaborated in these studies under contract with the Office of Scientific Research and Development. Throughout the collaboration copies of all reports were filed with the American and British co-ordinating bodies for distribution to the various participants in both countries. When these confidential reports were written :

it was never intended that they should be made available in their original form to a wider circle of readers. They were essentially interim reports, jottings from laboratory note-books, hastily

produced and circulated so that all engaged in the urgent co-operative effort could take immediate advantage of any recorded gain in knowledge.

As time went on, the success of the deep-culture method for the production of penicillin made the economics of any practical synthesis extremely exacting, and, in fact, a synthesis, intended either as a means of production or of providing unequivocal proof of structure, still remains to be accomplished. With the end of hostilities, the need for secrecy disappeared and it was decided that the findings, embodied in the long series of confidential reports, should be published in the form of a monograph for obvious reasons. As dissolution of the Office of Scientific Research and Development was imminent, the production of the monograph was sponsored by the National Academy of Sciences. The distribution of the subject-matter into monograph chapters according to organic chemical classification and physico-chemical techniques was determined, and authors for these chapters were selected in 1946. As we learn from the preface :

These selections were made on the basis of special familiarity with the field and it was agreed that authors should regard themselves as impartial reporters of pertinent information, irrespective of source.

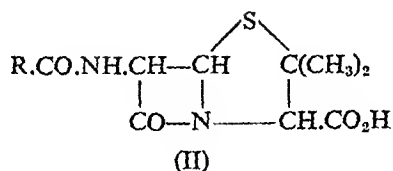
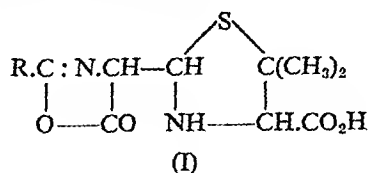
Let it be said at once that the authors have faithfully kept to their terms of reference because, although the historical development is there for anyone to read, the book is astonishingly free from sordid considerations of priority; in fact, this book and the work which it describes are a lasting monument to what can be achieved in the field of international collaboration when the guiding impulses are fundamental scientific matters, untainted by thoughts of commercial gain or political advantage. In December 1945 a brief account of the principal findings was published simultaneously in *Science* and in *Nature* with the consent of all the participants. The chemical work is now described in full for the first time in this monograph<sup>1</sup>, and it must be emphasized that it will be published in no other form. It is essential therefore that the abstracting organizations should be aware of this fact, and that the volume should be abstracted with the same thoroughness as is accorded to journal publications. The book is not merely the province of penicillin specialists for it contains much of lasting value to chemists with interests far removed from penicillin, and it should be found, side by side with contemporary volumes of the *Journal of the Chemical Society* and the *Journal of the American Chemical Society*, in every chemical library with any pretensions to completeness of coverage.

### Early Stages in Development

The first chapter summarizes the history of the chemical study of penicillin and draws attention to the essential developments, which, with much else besides, are treated in greater detail throughout the rest of the book. One of the first complications overcome was the fact that the Oxford, the Imperial College, and the American investigators were examining no less than three different compounds, and instead of there being a single unique substance called penicillin a group of closely related compounds existed. In view of the distinguishing groups which these three penicillins contain they were later designated 2-pentenylpenicillin, which was the form encountered at Oxford, *n*-amylpenicillin, the form studied at the Imperial College, and benzylpenicillin, the form

<sup>1</sup> For particulars, see p. 275.

examined by the American workers. The next three chapters (ii-iv) report upon the impressive progress made in the study of these three substances up to the end of 1943. By October of that year the Oxford workers were in a position to suggest the thiazolidine-oxazolone formula (I),  $R = C_5H_9$ , as the simplest expression for their form of penicillin. A similar formula (I),  $R = C_6H_5CH_2$ , was proposed independently by the Merck, Squibb, and Abbott groups for benzylpenicillin, but the lack of basic properties in penicillin led both the Oxford and Merck groups to propose as a possible alternative the  $\beta$ -lactam structure (II). Both formulae accounted satisfactorily for the products of degradation, and although some of the shortcomings of the thiazolidine-oxazolone formula were realized from the outset it nevertheless dominated the subsequent synthetic programme.



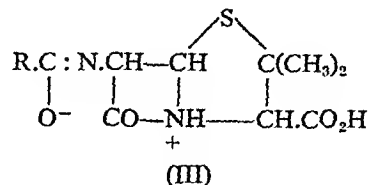
At first glance chapter v seems to be out of place and to interrupt the continuity of the story but it is difficult to see where else it could have been placed since the isolation and characterization of the different "natural" penicillins belong to the early stages of the penicillin saga. The demonstration by the Northern Regional Research Laboratory group that the addition of phenylacetic acid raised the penicillin titre when added to lactose corn steep liquor, and the acute observation by the Imperial Chemical (Pharmaceuticals) group, that the British strain of *Penicillium notatum* yielded 2-pentenylpenicillin when grown in surface culture on synthetic media and benzylpenicillin under the same conditions on a lactose corn steep liquor medium, threw a much-needed flood of light on the apparent vagaries of the mould, and paved the way for the elegant studies on the biosynthesis of penicillins carried out in the Lilly Research Laboratories, and described in chapter xix.

#### Transformation and Degradation Products

Chapters vi, vii, and viii reveal the continuing progress made in the study of transformation products of penicillin and of its degradation products. In chapter ix there is described the felicitous desulphurization of benzylpenicillin by the Merck group using Raney nickel, which afforded the first, and still the most direct, chemical evidence for the  $\beta$ -lactam structure. The products of desulphurization were desthio-benzylpenicillin, in which the  $\beta$ -lactam ring has now acquired a degree of stability considerably greater than it had in penicillin, and phenylacetyl-L-alanyl-D-valine; what could have been of more engaging textbook simplicity? Further evidence for the  $\beta$ -lactam structure is given in chapter x.

"The subtlety of the constitutional problem presented by the penicillin molecule led to the use in the attack on the problem of almost every known applicable physical method," and

the succeeding four chapters (xi-xiv) give admirable accounts of the x-ray-crystallographic investigations, infra-red spectroscopic studies, electrometric titration data, and ultra-violet absorption of penicillin. Of these methods, it fell to the x-ray technique to provide the data which ensured final acceptance of the  $\beta$ -lactam formulation of penicillin. Chapter xv is an entertaining chapter which starts by recapitulating the degradation reactions of the penicillins, passes on to consider theoretical aspects of their reactions, and closes with a spirited attack by Sir Robert Robinson on the "plain"  $\beta$ -lactam structure (II), which he considers not to indicate adequately the reactivity of penicillin, and arguments in favour of an alternative expression (III), a "formula" about which the x-ray crystallographers are critical (p. 351).



The next three chapters (xvi, xvii, and xviii) describe various aspects of degradation products of the penicillins. Although now known to represent a structure of inordinate instability with respect to both rings (chapter xxiv), the thiazolidine-oxazolone formula (I), as mentioned above, dominated the synthetic programme, and this is amply evidenced by the fact that chapter xxi, describing the considerable advances made in the chemistry of oxazoles and oxazolones, is the longest in the book, while chapters xxii-xxiv and xxviii present various aspects of attempted syntheses of penicillins. Various groups studied the possibility of synthesizing structure (I) by the condensation of suitably substituted 4-alkoxymethylene-5-oxazolones with penicillamine ( $\beta\beta$ -dimethylcysteine) and observed traces of biological activity in their crude products. By persisting in the study of this reaction, du Vigneaud and his collaborators finally isolated traces of pure benzylpenicillin by using the effective, though tedious, Craig counter-current distribution technique. There are also chapters describing extensions in our knowledge of thiazolidines (xxv) and  $\beta$ -lactams (xxvi), the synthesis of ring homologues of penicillin (xxvii), and methods for the assay of penicillins (xxix). An appendix gives information as to the origin, date of issue, and date of receipt of the individual progress reports which formed the basis of the monograph. Although it must be admitted that the final chapter in the chemistry of penicillin has not yet been written, this book greatly enriches the literature of organic chemistry and will form for many years to come a source of inspiration not only for those who would accept Nature's challenge and essay the writing of the final chapter but for many others besides.

#### Conclusion

At the end of the volume there is a subject index which is offered somewhat apologetically in the introduction (p. 1069), but it is, on the whole, a workable index, if not a complete one. It would have been helpful if a formula index had also been given. The glossary of trivial names of penicillin derivatives is valuable and will be of great assistance to newcomers to the literature of penicillin, although it would have been helpful if formulae had been used as liberally here as

they are elsewhere in the volume. It is one of the functions of editorship to decide between alternative methods of nomenclature, notation, and enumeration, and several unfortunate results are noted as the outcome of the lack of firm editorial direction. For example, there are no entries in the index under "enumeration," "numbering," or "nomenclature," and the numbering given in the glossary on p. 1070 appears to be the only hint of direction in the matter. As a result, the x-ray crystallographers have adopted a system on p. 338 (fig. 17) and proceed to use it on subsequent pages, but it does not correspond with the system on p. 1070. Then again, the first half of chapter xiii records infra-red spectroscopic data in terms of wave-numbers, while observations, and sometimes the same ones, are recorded in terms of wavelengths in the second half of the same chapter. As wavelengths are used, almost without exception, in recording data on ultra-violet and visible light absorption, it is desirable to adopt that convention also for recording infra-red absorption, as it is more familiar to organic chemists. How many

organic chemists, the reviewer wonders, could say without hesitation if they had ever used light of 16,970 and 18,312  $\text{cm}^{-1}$  and, if so, for what purposes? As far as technical editing is concerned, the handling qualities of the book would have been enhanced if at the tops of left-hand pages there had been given the numbers of the chapters and their titles as running headlines, with sectional headings at the tops of right-hand pages. The plates depicting the historic "motley assortment of dairy, garden, and domestic plumbing fittings" should be beside the text on p. 35 and not facing p. 22. There are a few tri- and penta-valent carbon atoms but generally a high standard of accuracy is maintained throughout the book.

The publishers deserve special praise for this beautiful example of modern book production, as both printing and binding are excellent examples of the respective crafts. The print in the theoretical sections is large and clear, and structural formulae, given with unusual liberality, are spaciouly laid out. A smaller size of type has been used to record experimental data but generous spacing ensures easy legibility.

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### 1507 Principles of Biological Assay

C. W. Emmens. London: Chapman & Hall Ltd., 1948.  
xv + 206 pages. 22 x 14 cm. £1 1s. [£1.05]

(i) The application of mathematics to biological measurements; (ii) means, variances and degrees of freedom; (iii) comparisons between groups; (iv) dose-response lines; (v) further discussion of dose-response lines; (vi) restrictions in design; (vii) polynomial coefficients; (viii) covariance; (ix) predicting from dose-response lines and planning assays; (x) the estimation of relative potency; (xi) the estimation of relative potency with unbalanced dosage groups; (xii) a  $2 \times 4$ -point assay with restrictions in design; (xiii) further designs for assays; (xiv) discontinuous variation; (xv) calculations involving probits; (xvi) probit assays; (xvii) assays based on reaction times; (xviii) groups of tests; (xix) choosing and measuring the response; (xx) the response linearly related to the dose. Appendix: notation. Index.

The controlled experiment is essential for most scientific advances. More especially is this true in biology and as a result biological assay is now a recognized tool for the study of certain properties of living matter, and for the standardization of drugs. Since the end of the First World War biological standardization has acquired a new and added significance as a result of the advances in chemotherapy and pharmacology. Therapeutic substances such as the antitoxins and tuberculins, vitamins and endocrine preparations, arsenicals and antimonials used in chemotherapy, cardiac drugs and antibiotics, all require accurate standardization. These standards, it is emphasized by Sir Percival Hartley in his foreword, were worked out on a firmly established international basis by the Permanent Commission on Biological Standardisation of the Health Organisation of the League of Nations. The establishment of these international standards has thus permitted statistical methods to be widely applied and fully exploited. This book very fully sets out the wide variety of biological reactions which have now been successfully exploited for the assay of therapeutic and other substances, together with the varying methods of treatment of the results of assay.

Those who carefully study this work will be fully informed on such subjects as the means of making comparisons between groups, dose-response lines, prediction from dose-response lines, discontinuous variations, probits and probit assays and how best to choose and measure the response. The importance of the provision of healthy stocks of animals is emphasized, for if intercurrent disease is present the basis of an assay may be obscured and even falsified. Adequate stocks of healthy, well-fed animals are as essential to the worker in biological assay as the balance, the microscope, and other instruments of precision are to workers in other scientific fields. Much of the work recorded in this admirable book owes its origin to the fact that the Department of Biological Standards at the National Institute for Medical Research at Hampstead was from its inception in the closest possible touch with professional statisticians. As a result it is no mere accident that a Continental writer has described Great Britain as "the home of modern biometry". An authoritative textbook from such a source is therefore of the greatest significance and value.

G. M. Findlay

### 1508 Etudes Chimiques sur la Tuberculose

Jean Paraf, Jean Desbordes, André Girard, S. Lewi, A. Abaza & Madeleine Paraf. Paris: L'Expansion Scientifique Française, 1948. 130 pages. 21 x 13 cm. 300 fr.

(i) Rôle des lipides et plus particulièrement des acides polysubstitués dans l'infection tuberculeuse; (ii) étude de l'équilibre enzymatique et vitaminique du tuberculeux; (iii) la chimiothérapie antituberculeuse—(progrès récents, promesses d'avenir); (iv) travaux récents sur la chimiothérapie antituberculeuse; (v) les antibiotiques (en particulier la streptomycine) dans le traitement de la tuberculose; (vi) étude de l'acide para-amino-salicylique dans le traitement de la tuberculose pulmonaire.

Ten years ago very little was known of the chemical composition of the tubercle bacillus and even less of the possibility of chemotherapeutic action on Koch's bacillus. Now, a very considerable knowledge exists of the protein, carbohydrate and lipid composition of this organism and much has been learnt of the role of fatty acids in determining the general symptoms of the disease such as fever and cachexia. After a brief introduction by Jean Paraf, he and Jean Desbordes give an account of the fatty acids of the tubercle bacillus and of the synthetic disubstituted fatty acids by means of which it has been possible to prove the role of these fatty acids in the genesis of the classical histological tubercular lesions. If the tubercular lesions are due to these acids it might be possible to destroy or transform them by means of enzymes or vitamins. This conception entails a study of vitamins in the tuberculous subject. Special consideration is given to the inhibition by nicotinic amide of the toxic effects of fatty acids obtained from the tubercle bacillus. Dr. A. Girard next describes the various types of chemotherapeutic compounds now available. These compounds include long-chain fatty acids, sulphones, *p*-amino-salicylic acid, 5-nitro-furaldehyde semi-carbazone, vitamin D<sub>2</sub>, and the antibiotics streptomycin, actinomycin, licheniform and certain products of *Pseudomonas aeruginosa*. More-detailed studies are given of the sulphones by Lewi, of streptomycin by Abaza, and of *p*-amino-salicylic acid by Madeleine Paraf. Each chapter contains a short list of references, some of which will be of considerable value to English readers since they refer to medical theses published in France. As in most French books there is no index, only a wholly inadequate "Table des Matières"; the paper is poor, and many of the chemical formulae are so smudged and in such small type that even with a magnifying glass it is not always possible to be certain what is represented by the general blur. Despite these minor criticisms a very large amount of useful information is compressed into this short book.

G. M. Findlay



## 1509 Streptomycin und Tuberkulose

Edited by G. Fanconi & W. Löffler. Basle: Benno Schwabe & Co., 1948. 357 pages; 233 illustrations; 35 colour plates. 24 × 17 cm. 30 Sw. fr.

(i) Einleitung; (ii) allgemeines; (iii) hämatogene Streuung; (iv) Organ-tuberkulose; (v) pathologische Anatomie; (vi) Literaturverzeichnis.

This is probably the most important and comprehensive volume so far published on the action of streptomycin in human tuberculosis. It embodies the results obtained in Switzerland in the treatment of all forms of tuberculosis with streptomycin.

After a brief introduction by the editors there are four introductory papers. H. Fischer deals with the experimental basis for streptomycin treatment; A. O. Fleisch describes the influence of streptomycin and of *p*-amino-salicylic acid on cellular respiration; O. Bucher compares the toxic action of streptomycin, *p*-amino-salicylic acid and sulphone on cells in tissue culture, and S. Moeschlin and his colleagues discuss the comparative effects in experimental tuberculosis of streptomycin, sulphone, *p*-amino-salicylic acid and combinations of these compounds. There then follow two long sections, the first dealing with tuberculosis as a blood infection and the second with tuberculosis of special organs. The toxic effects of streptomycin on the eighth nerve and the allergic reactions seen in those who handle streptomycin are well described, together with experimental toxic results in guinea-pigs. In a final section the pathological anatomy of miliary tuberculosis and tuberculous meningitis after treatment with streptomycin is very fully described and attention is drawn to the occurrence of myelomalacia in tuberculous meningitis treated with streptomycin. A very full bibliography ends the book. Most of the chapters are in German but a few are written in French and all the most important have English summaries. This is a work which should be read and carefully studied by all those who are investigating the effects of streptomycin in tuberculosis.

G. M. Findlay

## 1510 Studies in Air Hygiene

R. B. Bourdillon, O. M. Lidwell & J. E. Lovelock et al. London: His Majesty's Stationery Office, 1948. (Medical Research Council Special Report Series No. 262.) 356 pages; 104 figures; 33 plates. 24 × 15 cm. 7s. 6d. [£0.375]

(i) Methods of sampling air for bacteria; (ii) air disinfection by chemicals; (iii) air disinfection by ultraviolet radiation; (iv) air disinfection by heat; (v) air disinfection by recirculation through filters; (vi) masks; (vii) airborne bacteria observed in field trials; (viii) air hygiene in H.M. ships under wartime conditions; (ix) animal tests with infective aerosols; (x) general conclusions. Appendices. References.

The control of air-borne infection is one of the major problems of preventive medicine. The diversity of conditions in which control has to be attempted and, until recently, the lack of precise methods for measuring the bacterial content of air are among the reasons why air hygiene has not kept pace with advances in the control of water- and food-borne disease. This report is a symposium written principally by three workers who have studied air-borne infection at the National Institute for Medical Research, Hampstead, London, since 1942. It is not intended to be a comprehensive treatise on air hygiene: its purpose is to describe instruments which have been devised for sampling air for bacteria and to outline the theoretical and practical tests to which the instruments were submitted. The report also deals with many techniques for disinfecting air and with the conditions determining the effectiveness of these techniques, and it includes a critical evaluation of the various methods now available.

There are several ways of measuring the bacterial content of air. Much of the present work, however, was carried out with slit samplers in which air is sucked at high velocity through a narrow slit and allowed to impinge on a revolving plate of culture medium. This method allows the exact time when particular organisms are collected to be determined and hence it is of especial value when the concentration of air-borne organisms is changing rapidly. The technique enables the number of bacteria-carrying particles to be measured, but when it is desirable to measure large numbers of bacteria in air it is better to collect into a liquid rather than on a solid medium. The prevalence of bacterial clusters in the air of occupied buildings has obvious bearing on several aspects of air hygiene and this, together with possible errors and limitations of the methods employed, is fully discussed.

The second part of the report begins with a description of the test room in which the efficiency of chemicals as air-disinfectants was estimated. Attention is drawn to the need for circulating air in any test chamber at high rate when using agents which kill bacteria quickly. Of the many disinfectants tested the  $\alpha$ -hydroxy-acids, such as lactic acid, are of great interest because of their high efficiency. In preliminary trials one of these substances,  $\alpha$ -hydroxy- $\alpha$ -methylbutyric acid, was effective when allowed to evaporate from the surface of paper or fabric at room-temperature. The potential advantages of air disinfection at room-temperature are great and the method could probably be used in office or dwelling-house. Brief accounts are given of the disinfection of air by ultra-violet light, by steam and by passing air through furnaces where a temperature of 300° C. for half a second is required for complete sterilization. The purification of air in a military canteen by recirculating through filters and past ultra-violet lamps was found to be possible, but recirculating systems are costly and may be inconvenient.

Many other matters of practical importance are also described in the report. The value of various types of masks has been tested and attention is again drawn to the fact that air in the upper stories of a hospital or other building is much less contaminated than air at ground-level. Many hospital operating theatres have exhaust fans which suck in dirty air from surrounding rooms or corridors: this can be prevented by using an input fan of greater power than the exhaust fan. Studies were also carried out in submarines, warships and factories and it is suggested that present standards of ventilation which depend on the detection of body odour might well be replaced by a standard based on the bacterial content of the air. In addition to these and related subjects a short but valuable account is given of experimental techniques for the air-borne transmission of bacterial and virus infections to animals.

The aim of air hygiene is to reduce the contamination of air by pathogenic organisms, for it is unlikely that complete elimination of respiratory-spread infection will be attained by the methods described. However, a significant reduction of the respiratory pathogens in the air may well be important as there seems little doubt that the severity and mortality of these infections are closely related to the dose of organisms inhaled. As is pointed out in the general conclusions, daylight and sunlight, adequate ventilation and techniques for dust suppression all help in the elimination of bacteria from the air. The report is primarily concerned with the basic facts about air hygiene and it has laid reliable foundations on which future work can be built. The experiments are described lucidly and in detail and the worker in this field will also be grateful for the comprehensive list of references on the subject. The report should, however, be read by a much wider public than specialists on air hygiene. It contains important information for those who design hospital and other buildings, for the epidemiologist and indeed for all who are concerned with the advance of preventive medicine.

A. Macdonald

## 1511 Annual Review of Physiology. Volume XI

Edited by Victor E. Hall et al. Stanford, California: Annual Reviews, Inc. & American Physiological Society, 1949. ix + 643 pages. 23 × 16 cm. \$6

(i) Developmental physiology; (ii) reproduction; (iii) metabolic functions of the endocrine system; (iv) liver; (v) digestive system; (vi) visceral functions of the nervous system; (vii) somatic functions of the nervous system; (viii) bioelectric potentials in the nervous system and muscle; (ix) the electrical activity of the brain; (x) hearing; (xi) vision; (xii) physiological psychology; (xiii) muscle; (xiv) hematopoiesis; (xv) the lymphatic system; (xvi) heart; (xvii) peripheral circulation; (xviii) respiration; (xix) kidney; (xx) radiation; (xxi) permeability; (xxii) pharmacology. Indexes.

In the present volume of this well-known year-book, there is evidence of the editors' attempt to break away from the mere cataloguing of recent papers on physiology, and to bring to the reader's notice only the more important work. In a volume in which all aspects of physiology are covered by some 28 contributors, it is clear that some departure from this ideal is to be expected. Some contributors, such as the writers of the section on haematopoiesis, have by rigid selection produced a good and readable summary of recent work in a limited field—the formation of the erythrocyte in the present case. Others, like the writer on the physiology of vision, have found that their subject defies compression and merely listed the papers published. It might be well for the editors to pursue their policy even further and persuade contributors to emphasize the well-written and important papers and to

criticize where criticism is necessary. Thus, W. G. & V. J. Walter, the only British contributors, have given an admirable, though (on their own admission) unavoidably biased, summary of the electrical activity of the brain. For this they need scarcely apologize since the only point in having the articles written by authors of their standing is to ensure rejection of the bad and publicity for the good.

There is, as usual, much to interest the clinician in this volume. Such topics as anti-thyroid substances, experimental hypertension, pregnancy tests, experimental production of peptic ulcer, kidney function and liver function tests, and the pharmacology of the newer analgesics and of the ganglionic and adrenergic blocking drugs are in the province of the physician as well as of the physiologist. Attention may also be drawn to the summary of work on effects of radiation, unfortunately of importance to all, and to the interesting review of physiological psychology.

S. S. B. Gilder

## 1512 Lecciones de Patología Médica (Enfermedades del Hígado). Volume VI

C. Jiménez Díaz. Madrid: Editorial Científico-Médica, 1948. viii + 998 pages; 360 figures. 25 × 17 cm.

Few subjects can compete with the liver in attracting enquiring minds. Professor Jiménez Díaz has aimed to review everything worth knowing about the functions of this organ and the diseases to which it is subject.

Physiology and functional tests occupy eight lectures, greatest reliance being placed on the cephalin-cholesterol and thymol turbidity tests and on the estimation of plasma cholesterol esters. The inability of the failing liver to provide the materials for building enzymes needed by the vital organs ("dysenzymatic state") would account for the varied clinical features of cholaemic patients, their metabolic, neurological and renal upsets. This sounds rather speculative in view of the difficulties in substantiating it experimentally.

Many pages are devoted to jaundice and necrosis of the liver with a complete review of the modern literature on hepatitis. Jiménez Díaz thinks a lesion of the capillaries and the reticulo-endothelial system, by the virus of hepatitis, is the primary event in hepatic necrosis. Rossie's "serous inflammation" is analyzed in that connexion.

In dealing with cirrhosis he broadly agrees with Himsworth's classification into three main types: Laennec's, post-necrotic scarring, and cholangitic. Emphasis is placed on histology and an attempt is made to define the structural changes in the spleen. Clinical pictures are not neglected. Full descriptions are given and numerous cases presented. Hanot's cirrhosis is narrowed to these features: clinically—juvenile patients, early jaundice, recurrent fever, hepatosplenomegaly, "rheumatic pains" and arthritis, adenitis; histologically—round-cell infiltration of portal spaces and around sinusoids, proliferation of the reticulo-endothelial system, hyperplasia of reticulum amongst the cells, a sort of intralobular fibrosis, gross dilatation of sinusoids, and fibrosis of spleen and kidneys. An impressive series of photomicrographs is shown and a slowly evolving infection, perhaps by a virus, is suggested. A relationship with the agent of rheumatic fever is hinted. The exposition, however, is more interesting than convincing.

Banti's syndrome, apparently common in Spain, is considered to be of varied etiology, some cases being due to thrombophlebitis of the splenic vein, occasionally following abdominal trauma.

There are three interesting lectures on hydatid disease. The condition, very common in Spain, can mimic varied clinical syndromes (biliary colic, portal obstruction, suppurative cholangitis). Syphilis, abscess, cancer, and cirrhosis in children are also discussed. In fact, every aspect of liver pathology (excluding the biliary passages) is covered. Experimental, biochemical and histological works are widely quoted and many personal investigations are brought forward to support opinions favoured, but it is hard to achieve a critical synthesis of the enormous amount of information displayed. This series of lectures seems hardly appropriate for students. Perhaps it is for future professors or highly specialized research workers. On the average student the impact must be formidable and bewildering.

Despite its incredibly extensive and erudite information this cannot be called a reference book as it lacks a bibliographical index. This omission, perhaps, is less serious than it sounds, if one considers that Jiménez Díaz and his collaborators have published

numerous papers on liver pathology with original observations and extensive references. However, a list of personal publications seems indispensable.

With adequate bibliography the book would be one of the most outstanding and up-to-date treatises on the liver.

E. T. B.

## 1513 Fatty Liver Disease in Infants in the British West Indies

J. C. Waterlow. London: His Majesty's Stationery Office, 1948. (Medical Research Council Special Report Series No. 263.) 84 pages; 12 plates. 24 × 15 cm. 2s. [£0.1]

Introduction; previous work. Part I. Clinical, biochemical and pathological observations. Part II. Pathogenesis and relationship of some features of the syndrome. Summary and conclusions. References.

This is a report on the investigation of infantile liver disease, prevalent in the British West Indies, the outstanding features of which are fatty infiltration of the liver, accompanied by oedema and muscular wasting. It is assumed, without conclusive evidence, to be due to prolonged feeding on a diet poor in protein and relatively rich in carbohydrate. The number of cases investigated was no greater than 15, to describe which a brochure approaching 100 pages would seem more than sufficient. The syndrome dealt with has been described under the African name of kwashiorkor ("red boy") dermatosis, or as "infantile pellagra", but Dr. Waterlow cautiously prefers to avoid these terms, which emphasize the skin lesions (which as often as not were absent), and to speak of "fatty liver disease." Similar syndromes have been described in diverse parts of the world, mainly in tropical and subtropical countries; all seem to have in common the especial incidence in infancy, a high mortality, lack of response to vitamins, and the presence of a severe degree of fatty infiltration in the liver. It is the opinion of Dr. Waterlow that the latter lesion dominates the disease and is the cause of failure to respond to treatment and of death when this occurs.

In the 15 cases analyzed, the average age was about nine months; all were breast-fed and thrived until weaned and on an average two to six months elapsed thereafter before the infant was admitted to hospital. Oedema and vomiting were the presenting signs and by this time the condition was often grave. The diet after weaning consisted of maize porridge, arrowroot, sweet potatoes, plantains or oatmeal; some milk, judged to be rarely more than half a pint (0.284 l.) a day, was given. There was no real evidence that children not developing "fatty liver disease" had a strikingly different diet from those who did develop this.

In the affected cases the liver was enlarged in all but one, and at post-mortem examination was found to be grossly fatty, the percentage of fat in the moist tissue being of the order of 35 to 45 per cent. Twenty-seven liver biopsies were made which revealed fat; a fuller account of these would have been desirable as post-mortem estimations of liver adiposity are liable to be misleading quantitatively. Oedema was frequently, but not always, present, and its severity was not related to the degree of liver change. It was noted that fat was lost from the omentum, mesentery and perinephric region, but often the thighs and legs had considerable subcutaneous fat and in many cases the face remained chubby; in contrast to this, marasmic children without this liver disease showed universal wasting and a shrunken facies. Other findings were a loss of weight of 25 to 30 per cent, and deficiency in serum protein, especially albumin, in cases with oedema.

Amongst other observations of interest was the presence of a mild hypochromic anaemia—for which iron was given with little effect—and post mortem an excess of microscopically demonstrable iron in both liver and spleen; but a similar siderosis was found in infants dying of malnutrition without fatty livers, and it is concluded that this change was due to a failure of utilization. A curious observation was that the faeces contained an excess of fat; the total quantity of this was not influenced by treatment, which merely reduced the percentage of neutral fat and increased that of soaps.

The prognosis was in general bad: of the 15 cases followed, six died. Treatment was not very satisfactory; best results were obtained by increasing the milk in the diet to about a litre a day. Vitamin B deficiency was present in some cases and was improved by specific therapy, but this had no effect upon the course of the main malady. Choline and methionine, in the few cases in which these substances were given, produced no improvement.

An attempt was made to correlate this fatty infiltration with the development of cirrhosis. In Jamaica (but not in Trinidad or British Guiana) cirrhosis in children is stated to be common, which might support the idea of a causal connexion. A few cases of liver fibrosis were encountered and their histology described, but no definite sequence is proved.

The general conclusion is that the disease described is the same as the African kwashiorkor, but the latter is complicated by an associated vitamin B<sub>2</sub> deficiency, causing skin lesions, which are not present in the West Indian cases. Dr. Waterlow states that the specific feature of the syndrome is the appearance of exogenous (i.e., dietary) fat in the liver and that the cause of this is inadequate feeding after breast-feeding has been stopped. From this there follows gross muscular wasting, anaemia, plasma protein deficiency, oedema and some liver deficiency as judged by the bromosulphthalein clearance test, and it is suggested that hepatic cirrhosis may be a late result. This sequence is not altogether easy to follow and requires the presumption that the children were unable to utilize fat and were therefore, in effect, suffering from starvation, and as a consequence were deficient in protein. When this was supplied in the form of milk, improvement set in. It is open to further investigation to show at what point the chain of events was set going, and it would seem probable that some as yet undetected factor must intervene if, as it appears, these children had essentially the same diet as many others who remained well. It is of importance to note that the pure "lipotropic" substances such as methionine, choline and inositol produced no improvement, whereas milk did.

J. Henry Dible

#### 1514 Pathologie des Kohlehydratstoffwechsels

E. Frank. Basle: Benno Schwabe & Co., 1949. 342 pages; 17 illustrations. 23 x 16 cm. 24 Sw. fr.

(i) Experimentelle Diabetesforschung; (ii) Hypophysäre Diabetesformen in mus; (ix) die Glykogenspeicherkrankheit; (x) hydrastoffwechsels bei der B<sub>12</sub>-Avitaminose; (xi) (xii) die selteneren Formen der Melliturie.

This is a most interesting and useful book. It is written by a pupil of Minkowski who had an authoritative account, from the lips of the master himself, of the steps which led to the removal of the pancreas from a dog and of the subsequent observations of laboratory assistant and professor. (Incidentally, this should give the quietus to many stories circulating in physiological laboratories about the elusiveness of the discovery that the animal's urine contained glucose. Further, it may result in a greater appreciation of Minkowski's work in laying the foundation of our modern knowledge of diabetes mellitus.) It is also interesting because, though the book is thoroughly German in its comprehensiveness and its massing of detail, it recaptures the spirit of liveliness and critical insight which characterized Minkowski's life and work, but which has been so lacking in German science, and other affairs, for decades.

It is an extremely useful book in that it is no mere collation of facts about diabetes mellitus, but gives a comprehensive view of the whole of the disturbances of carbohydrate metabolism, both from the experimental and the clinical aspect. The author has held throughout the view that the knowledge of the experimental pathology of diabetes is best appreciated by one versed in clinical research—by one who has been captivated by the problems of carbohydrate metabolism in his student years and has steadfastly worked on them at the bedside and in the laboratory. And it may be said that the author has achieved his object in demonstrating the value of this view. The book can therefore be recommended to anyone—physiologist, biochemist or clinician—who wishes to understand and do work upon the disturbances of carbohydrate metabolism. The research worker and the clinician will, of course, criticize the emphasis on and interpretation of different phenomena, but they will nevertheless be stimulated to further thought and work. As the author himself says, "If you solve a riddle another presents itself at once."

Space does not permit of a list of the subjects treated under the title *Pathologie des Kohlehydratstoffwechsels*. The reader who is attracted by the above had better borrow the book from a medical library and glance through it. He is almost certain to want a copy for his own.

V. H. Mottram

#### 1515 Bone Marrow Biopsy. Haematology in the Light of Sternal Puncture

S. J. Leitner. English translation revised and edited by C. J. C. Britton & E. Neumark. London: J. & A. Churchill Ltd., 1949. xi + 433 pages; 7 plates; 194 text-figures. 26 x 16 cm. £2 2s. [£2.1]

(i) Introductory and historical; (ii) technique of sternal puncture; (iii) cell counts on the sternal marrow; (iv) marrow cells; (v) maturation curves; (vi) sternal puncture; (vii) disorders of marrow; (viii) disorders of thrombocytopoiesis; (ix) disorders of the marrow; (x) disorders of maturation; (xi) sternal marrow in liver disease; (xii) disorders of haemopoiesis in endocrine disorders; (xiii) the effects of radium and X-rays on bone marrow; (xiv) the demonstration of pathogens in sternal marrow; (xv) metabolism of marrow and blood cells; (xvi) the defence reaction of marrow cells; (xvii) tissue culture of marrow cells; (xviii) summary. Index.

Several attempts have been made to rewrite haematology, starting with the formative tissues and working down the genealogical tree until the formed elements of the peripheral blood are reached. Such a method became possible when marrow puncture, as introduced by Arinkin, became widely used.

There are several books in which this more modern method is followed: there was the enormous war-time work of Thaddeus, which formed an almost inexhaustible reference book of the Continental literature up to 1942; Rastelli's well-illustrated monograph; Forteza Bover's admirable volume; and, smaller but therefore more widely useful, the work of Émile-Weil & Perlès. Thus there were books in German, Italian, Spanish and French, while the only English book on the subject is the small volume, mainly of personal experiences, *Sternal puncture*, by Piney & Hamilton-Paterson, of which a new edition was published in April 1949.

All the European books that have been mentioned are either too large and costly, like that of Thaddeus, or too parochial (being purely Gallie) like that of Émile-Weil & Perlès. Hence the need for a volume of reasonable size, with an adequate but not excessive review of the literature. This need was met by the original Swiss edition of Leitner's book, which, however, suffered from inevitable lacunae, because European and American medical journals were not obtainable during the war.

Britton and Neumark have done more than translate the book: they have amplified the bibliography considerably, mainly by addition of American and British references, while they have excised some masses of Teutonic verbiage—much to the benefit of the reader. The original edition gave the full titles of all the references, but, unfortunately, paper-shortage has made that impossible in Great Britain. The bibliography is, therefore, less useful than it could have been.

The text is full enough for every purpose; and there is no truth in the assertion that this translation is redundant because those persons who need so highly specialized a book can read the original Swiss edition. This pays too great a compliment to the linguistic knowledge of the Anglo-Saxons; and even if it were true, the translation would still not be redundant because Britton and Neumark have modified the original so much that it is now a new (and much better) book.

The illustrations are plentiful but of varying quality. The coloured plates are perhaps rather diagrammatic but are both instructive and beautifully executed. Many of the photomicrographs are quite unrecognizable, while a few are excellent.

For those who need a fairly large book on the histology and histopathology of the bone marrow, this book can be highly recommended.

A. Piney

#### 1516 An Atlas of Bone-Marrow Pathology

M. C. G. Israëls. London: William Heinemann Medical Books Ltd., 1948. x + 79 pages; 12 plates; 3 figures. 25 x 19 cm. £1 10s. [£1.5]

(i) Nomenclature and development of the blood cells; (ii) technique; (iii) the morphology of the marrow cells; (iv) the normal bone-marrow picture; (v) bone-marrow changes in disease; (vi) bone-marrow in infants and children; (vii) differential diagnosis and indications for sternal puncture. Bibliography. Index.

This book "sets out to provide an authoritative, accurately illustrated account of the bone marrow in health and disease for the guidance of physicians and pathologists." Unfortunately, the goal has not been reached. The nomenclature has been kept as simple as possible, and the extremely brief descriptions of each

type of cell are accurate and can easily be followed. One of the gravest defects of the book is that the descriptions of the staining reactions of the cells are not accurately reproduced on the plates.

The first seven plates illustrate several examples of each type of marrow cell but it is true to say that relatively few of them present any close resemblance to the elements as seen under the microscope. These plates are followed by five others, on each of which there are four microscopic fields. This plan is excellent inasmuch as the plate is on one page and the description on the opposite one. Unfortunately, a "flimsy," on which are printed outline guides, is interposed between the plate and the text, a plan which makes it extremely difficult to see to which elements the legends apply.

Among these plates there is again a grave defect, in that the staining appears to be peculiar. Thus, on Plate 8 the red corpuscles are bright yellow, but on Plate 9 they have the pinkish colour to which we are accustomed. On some of the plates, the tints are so faint as to make it quite impossible to hazard a guess at the nature of the cells. Indeed one gains the impression, from the pastel-like characters of the plates, that accuracy has been sacrificed to artistic charm.

It is difficult to understand to whom a book of this sort would be valuable: for the pathologist who is not primarily a haematologist it is inadequate; for the general physician it is too incomplete; for the student it contains too much detail; while for the professional haematologist it is both too elementary and too incomplete.

That a book of this sort is needed in English has been shown by the success of Blaekfan & Diamond's *Atlas of the blood in children*, so that a new edition of Israël's book, with really accurate well-printed plates, would fill a need, especially as the Continental books are large and expensive.

A. Piney

### 1517 Sternal Puncture: a Method of Clinical and Cytological Investigation

A. Piney & J. L. Hamilton-Paterson. Fourth edition. London: William Heinemann Medical Books Ltd., 1949. xv + 89 pages; 14 colour plates; 4 figures. 22 x 14 cm. 15s. [£0.75]

(i) The myelogram; (ii) the marrow in leukaemia; (iii) neoplastic and allied conditions of the bone-marrow; (iv) the anaemias; (v) erythraemia and allied states; (vi) infective diseases; (vii) hypoplasia and aplasia of the bone-marrow; (viii) some protozoal diseases; (ix) the technique of sternal puncture. Index.

The 4th edition of this useful little book is characterized by several additions and changes, most of which are improvements. The chapter on neoplastic and allied conditions of the bone marrow is largely rewritten, but clinicians and pathologists want to know more about the marrow changes in this far from homogeneous group of diseases. Although modern opinion has returned to Aschoff's original view that most myelomata are of the plasma-cell type, the authors continue to recognize plasma-cell, erythroblastic, myeloblastic and lymphoblastic types. The statement that "Ewing's tumour is a clear example of a growth that arises from the reticulo-endothelium of the marrow" is a most surprising one, especially in view of some paragraphs on this controversial topic only six pages away. In the chapter on erythraemia and allied states the authors have misinterpreted Duesberg's paper on anaemia due to faulty differentiation of erythroblasts.

Several misprints which were in the previous edition remain. The authors puncture the sternum through the angle of Louis, but do not state how much marrow should be aspirated. While the precursor of the red cells is called the *pro-erythroblast*, the authors continue to use the term *premyelocyte* instead of *promyelocyte*. That there are 2-3 per cent megaloblasts in the normal bone marrow, and small numbers of megaloblasts in haemolytic or aplastic anaemia and in sedormid purpura and kala-azar, is at least doubtful. Considering that mitotic figures are so rarely seen in myelocytes, the statement that "in health, almost all the polymorphs arise from mitotic divisions of pre-existing myelocytes" is hardly correct.

The new plates of colour photomicrographs of megaloblasts and plasma cells are instructive as are the plates retained from previous editions, but the barbed wire type of reticulocytes is surely very unusual. The index remains almost unchanged, but might usefully be enlarged. This reviewer is a little puzzled as to the reason why in Lord Horder's foreword and on the spine of the book the name of only one of the authors appears.

E. Neumark

### 1518 Studies on the Formation of Cellular Substances During Blood Cell Production

Bo Thorell. London: Henry Kimpton, 1947. 120 pages; 59 figures. 23 x 14 cm. 12s. [£0.6]

Part I. (i) The development of the cells of the blood in the adult; (ii) the endocellular organization for the formation of protein; (iii) the procedure for microspectrographic analysis of living bone marrow cells; (iv) cytochemical analyses of normal bone marrow; (v) the endocellular growth mechanism during the blood cell formation; (vi) the relationship of the cellular growth processes to the gene material. Part II. The relationship of specific cell differentiation processes to the growth of the cell. (vii) Erythropoiesis; (viii) growth and differentiation processes during the formation of other tissue cells. Part III. Cytochemical analyses of the formation of blood cells in certain pathological conditions. (ix) Disturbances of growth in the nucleated blood cells; (x) disturbances in the erythropoiesis. References.

The work carried out in the Department for Cell Research of the Caroline Institute, Stockholm, under the direction of Professor T. Caspersson, has led to the postulation of a "cytoplasmic protein-forming system". Part of the nuclear chromatin of the cell, designated the nucleolus-associated chromatin, produces substances composed of ribose nucleic acid, and proteins rich in diamino-acids. These accumulate to form the main bulk of the nucleolus from whence they diffuse outwards through the nuclear membrane into the cytoplasm, where an intense production of ribose nucleic acid occurs. Concurrently the amount of cytoplasmic proteins increases. The present monograph is concerned with investigations carried out to determine whether similar intracellular processes occur during the growth phases of haematopoiesis.

The author describes the theory and technique of the cytochemical analysis of living bone marrow cells. Microspectrographic methods were employed enabling quantitative determinations to be made of their polynucleotide and haemoglobin content. For the former he used a photographic method combined with photometry for use with ultra-violet radiations, and for the latter a photoelectric method for working in the visible spectral range. Additional methods which were employed included ultra-violet micrography, Feulgen staining, cytometry and macrochemical analyses.

The results of this investigation demonstrate that the new formation of intracellular proteins (growth) during haematopoiesis takes place at an early stage of development in the presence of high concentrations (more than 5%) of ribose polynucleotides both in the cytoplasm and nucleolus, and that the cellular mechanism involved is similar to that of other growing cells previously studied, e.g. embryonic cells. After the initial phase of growth the cytoplasmic ribose nucleotide concentration falls to less than 0.5%. During erythropoiesis the main synthesis of haemoglobin does not begin until the fall in intracellular ribose polynucleotide content has occurred.

With increased pathological growth, as in acute myeloid and lymphatic leukaemia, there is a definite hypertrophy of ribose polynucleotide metabolism correlated with the new formation of cellular proteins. In certain anaemic conditions, such as pernicious and haemorrhagic anaemia, there can be demonstrated an abnormal polynucleotide and haemoglobin content of the cytoplasm during cytogenesis.

This work is a good example of the value of the techniques of ultra-violet micrography and microspectrography for investigating cytological problems. The author has provided another convincing illustration of the intimate relation between cell growth and nucleotide metabolism. The postulated mode of functioning of the intracellular mechanism during the growth of the cytoplasm may, however, need reconsideration when more is known about the function of such cytoplasmic organelles as the mitochondria and microsomes.

R. J. Ludford

### 1519 Human Embryology and Morphology

Arthur Keith. Sixth edition. London: Edward Arnold & Co., 1948. xii + 690 pages; 578 figures. 22 x 14 cm. £2

(i) Early changes in the development of the ovum and embryo; (ii) the manner in which a connection is established between the foetus and uterus; (iii) the primitive streak, notochord and somites; (iv) physiological and pathological embryology; (v) age changes in the embryo and foetus; (vi) the spinal column and back; (vii) the segmentation of the body; (viii) central nervous system—differentiation of the brain and the spinal cord; (ix) the mid- and hind-brains; (x) the fore-brain or prosencephalon; (xi) the fore-brain or prosencephalon (*continued*); (xii) the cranium; (xiii) development of the face; (xiv) the teeth and apparatus of mastication; (xv) the nasal cavities and olfactory structures; (xvi) development of the structures concerned in the sense of sight; (xvii) the organ of hearing; (xviii) pharynx and neck; (xix) tongue, thyroid and structures developed from the walls of the primitive pharynx; (xx) organs of digestion; (xxi) organs of digestion (*continued*); (xxii) circulatory system; (xxiii) circula-



tory system (continued); (xxiv) respiratory system; (xxv) urogenital system; (xxvi) urogenital system (continued); (xxvii) urogenital system (continued); (xxviii) development and differentiation of the limbs; (xxix) development of bones and dages. Index.

This well-known textbook was first published in 1902 when its author was lecturer in anatomy at the London Hospital Medical College. For many generations of British medical students its successive editions have been the introduction to some of the more stimulating aspects of human anatomy. The reviewer, for one, well remembers his excitement when the volume first came into his hands. In it there was an escape from the minutiae of topography which, coupled with fascinating vistas of the phylogenetic and ontogenetic background to human structure, revealed human anatomy as a science rather than an examination hurdle and a discipline. No one who met this book in his salad days can fail to hold it in affectionate regard.

The first edition was unpretentious enough, having for its criterion, as Sir Arthur discloses in the preface to the present volume, clinical utility. "In subsequent editions my utilitarian ideal retreated more and more into the background. Who can tell what the clinical utility of any newly-discovered fact may prove to be?" This change in Sir Arthur's viewpoint is most interesting, for not only does it represent a change in his personal attitude but it reflects an alteration in the mental climate of British work in anatomy in the course of the present century. In the nineteenth century, in spite of much lip-service to the Hunterian tradition and method, and the neglect of the fundamental revelations of the theory of evolution, anatomy in the English-speaking world was largely the handmaiden of surgery—ancillary in the worst sense of the word. It is not the least of Sir Arthur's distinctions that he was one of the small group that broke the thralldom of his subject to operative surgery and established human anatomy quite firmly in the field of biology. And his book has had a part in bringing about the change.

The present edition has been carefully brought up to date. The references to the recent literature are not only full but are accompanied by notes which are always helpful and sometimes extremely sagacious. The style, as is to be expected from the author's pen, is easy. Indeed, considering the complexity of many of the problems discussed, it can even be said to be graceful. It is in this very ease of presentation that a possible defect of the book may, rather paradoxically, be found. The reader may be so carried away by the easy style that he may consider he understands a difficult problem when, in fact, he has been, always engagingly, it must be admitted, "fobbed off" with a re-statement. And, often, statements are made with an almost cavalier disregard for the facts and difficulties of the problem. For example: "We are at least justified in assuming that the parachordal part of the skull is the oldest, and is therefore known as the *palaeocranium*"; whereas the prechordal part is more recent and is for this reason known as the *neocranium*" (p. 231). The introductory words to this almost certainly incorrect statement (indeed Sir Arthur gives weighty authority for an alternative explanation in a note to this passage) are so completely disarming that the unwary will almost certainly be "taken in" by the whole statement. There are many equally deceiving passages elsewhere in the text. The figures, too, are often unworthy of the text and of the subject.

Notwithstanding any critical remarks, however, this edition is an extraordinary achievement for a man of Sir Arthur's age, varied interests and activities. To few of us will be given his years; to even fewer the ability and zest, after having actively lived those years, to present a complicated subject so freshly and so currently.

J. D. Boyd

## 1520 *Éléments d'Embryologie*

A. Celestino da Costa. Second edition. Paris: Masson & Cie, 1948. viii + 583 pages; 492 figures. 24 × 16 cm. 2300 fr.

Part I. Préliminaires. (i) Reproduction des organismes; (ii) les gamètes; (iii) le zygote, fécondation et parthénogénèse; (iv) mécanisme cytologique de la transmission héréditaire. Part II. Embryologie générale. (v) Segmentation; (vi) gastrulation; (vii) annexes embryonnaires; (viii) formation générale du corps de l'embryon; (ix) facteurs et mécanismes du développement; (x) anomalies du développement. Part III. Embryologie spéciale. (xi) Formation du squelette et des organes de mouvement; (xii) formation de la peau et ses annexes, du système nerveux et des organes des sens; (xiii) formation du sang et de l'appareil circulatoire; (xiv) formation des appareils digestif et respiratoire, des dérivés branchiaux et des sécrètes; (xv) formation des appareils urogénital et surrénal. Appendice: aperçu de l'histoire de l'embryologie. Table alphabétique des matières.

Embryologists will generally welcome this new edition of Professor Celestino da Costa's book. To include in one manageable volume the "elements" of embryology is no small feat, and the selection of items for inclusion must necessarily be a matter of preference. It is probably because the author's intention was to provide, at the same time, a core of basic information on subjects related to embryology that he has devoted over a hundred pages in his book to gametogenesis, fertilization, and mendelian genetics. The importance and value of these subjects in medical education need no emphasis, but it is a matter for consideration whether it is advantageous to include them as a sort of preface to a work of embryology of this kind. The treatment accorded to them is a trifle old-fashioned, and the space so occupied is at the expense of the more legitimate subjects which a reader would expect to find under the title of the book.

With special attention to the mammalian and human types, the author describes the chief events in the development of the embryo, and the various organ-systems are dealt with in turn. While these accounts are well balanced and complete, the work is not quite up to date on some points. For instance, the recent work on the derivatives of the neural crest and their significance for the theory of the germ-layers has largely exploded the importance of the latter, a fact of which the reader of this book would perhaps not become aware.

The section on the development of the skeleton is hardly adequate in view of the information now available, and the same is the case with the placenta. As regards general principles, the obsolete theory of recapitulation still rears its unfortunate head in the pages of this book and stands in the way of more modern and objective interpretations of the relations between ontogeny and phylogeny.

For all that, however, the book remains a solid contribution to the teaching literature of a difficult subject.

## 1521 *The Physiology of the Eye*

Hugh Davson. London: J. & A. Churchill Ltd., 1949. xii + 451 pages; 301 illustrations. 22 × 15 cm. £1 12s. [£1.6]

Introduction. (i) Structure of the eye. Section I. Intra-ocular dynamics and the transparent tissues. (ii) Aqueous humour and the intra-ocular pressure; (iii) the transparent structures. Section II. The mechanism of vision. (iv) Structure of the retina; (v) measurement of the stimulus; (vi) general aspects of vision; (vii) electrical effects of stimulation; (viii) photochemical aspects; (ix) flicker; (x) visual acuity; (xi) adaptation; (xii) theory of colour vision. Section III. The muscular mechanisms. (xiii) Extra-ocular muscles and their actions; (xiv) torsion and Listing's Law; (xv) binocular movements; (xvi) nervous mechanisms in the control of the eye movements; (xvii) the pupil; (xviii) accommodation; (xix) the protective mechanism. Section IV. Visual perception. (xx) The visual pathway; (xxi) higher integrative activity; (xxii) projection of the retina; (xxiii) monocular perception of depth; (xxiv) cyclopean projection; (xxv) stereoscopic depth perception; (xxvi) retinal rivalry and ocular dominance; (xxvii) binocular aspects of the light, colour and form senses; (xxviii) the perception of motion. Section V. Optics. (xxix) Reflection; (xxx) refraction at plane surfaces; (xxxi) refraction at a single spherical surface; (xxxii) refraction by spherical lenses; (xxxiii) refraction by the eye; (xxxiv) ametropia and accommodation; (xxxv) non-spherical lenses and astigmatism; (xxxvi) neutralization and decentring; (xxxvii) contact lenses; (xxxviii) ophthalmoscopy; (xxxix) retinoscopy; (xl) optical constants of the eye; (xli) defects in the image; (xlii) interference, etc. Index.

It is never an easy matter to provide an adequate review of a textbook and *Physiology of the eye* is no exception to this. The chapter titles illustrate the general lines on which it is written; each topic is treated with clarity and a wealth of important detail, some of it relating to investigations carried out by the author and his co-workers.

One has the feeling that if modern papers on ophthalmology are to be read intelligently, this book provides the indispensable groundwork for them. Adequate accounts are given, for example, of the mechanics of the formation of the aqueous humour, of the electrical phenomena associated with stimulation of the retina, of alpha and beta adaptation, of Granit's work on colour vision and of many other subjects of modern research, such as the use of x rays for measuring the length of the eye, its refractive power and the size of the retinal image. Fundamental matters are also not neglected and the ophthalmologist who is a little hazy as to the meaning of Listing's plane, Panum's circle, or the horopter, will find these clearly explained.

It may seem invidious to offer criticisms of such an admirable volume, but since future editions are certain to be called for, they may have some value. It occurred to the reviewer that: (i) The description of the actions of the vertically acting, extra-ocular muscles might be simplified; the author appeared to be so anxious to include everything, so to speak, that he has produced an account



which is difficult to follow, at any rate on a first reading. (ii) The explanation of retinoscopy is also difficult to follow and so are the figures, particularly figs. 266-271, in which a ray of light is shown apparently passing through the observer's iris. (iii) There did not appear to be any account of those entoptic phenomena which allow the observer to see his own retinal blood vessels and corpuscles.

These are all minor matters, however, and the author is to be congratulated upon having produced a classical volume which will be of the greatest value to students and to those whose fate it is to attempt to teach them. Job is reputed to have wished that his adversary had written a hook; had his adversary been Dr. Davson, however, the quarrel would surely have ended when the hook was read and it would have, as Job says, been bound as a crown to him.

F. H. Williamson-Noble

## 1522 Vitamin A Requirement of Human Adults : an Experimental Study of Vitamin A Deprivation in Man. A Report of the Vitamin A Sub-Committee of the Accessory Food Factors Committee

Compiled by E. M. Hume & H. A. Krebs. London: His Majesty's Stationery Office, 1949. (Medical Research Council Special Report Series No. 264.) 145 pages; 3 plates. 24 x 15 cm. 3s. [£0.15]

(i) Concise account of the experiment; (ii) elaboration of special aspects; (iii) details of the evidence. General summary. References.

Most research is planned to answer a question or solve a problem, and the best and most fundamental are generally posed by the investigators themselves, for they are the only people likely to be well enough acquainted with the subject to be able to do this. They tend to set themselves problems, moreover, which they are likely to be able to solve with the means at their disposal and which will give them interesting results, for only by so doing are they likely to get any return for their labour within a reasonable time.

During the war the Ministry of Food asked the Medical Research Council for information about the vitamin A requirement of human adults. No good answer could be given to this question and it was not a problem which would have attracted many investigators in times of peace, for it involved the almost impossible task of collecting enough subjects to represent the general population and of subjecting them to a deficient diet for a considerable time. Owing to the war, however, subjects were obtainable and a place where they could be accommodated was ready to hand. The Vitamin A Sub-Committee of the Medical Research Council, therefore, undertook to try to solve this problem and this report, No. 264, is a description of how their team set about it and of the results which were obtained.

It proved to be a much more difficult problem than was expected because it took a surprisingly long time to use up the stores of vitamin A present in the subjects when the experiment began, and until this had been done it was impossible to find out how much the daily food had to supply to promote good health. The 23 subjects had to live on a very monotonous diet which was reckoned to contain less than 70 i.u. of  $\alpha$ - and  $\beta$ -carotene a day, and practically no vitamin A. Seven subjects were given vitamin A supplements from the first, sixteen were not, and it was intended to continue the experiments until the latter showed definite signs of deficiency. Some of the subjects lived on this diet for two years,

which speaks very highly both for their own devotion and for the persistence and inspiration of the investigators. The organization of the experiment was most elaborate and is worth studying as a model for similar work in the future. Vitamins were assayed in foods, plasma and faeces by several different laboratories. Clinical examinations were made and dark adaptations tested. In short, "... the greatest possible variety of examinations which might be relevant" were carried out—but few of the subjects developed any signs of deficiency, and in the end only three out of the sixteen starters showed unmistakable signs of it. Of these, two were treated with carotene and the other with vitamin A. Some of the earlier work was confirmed. It was shown, for instance, that it was easy to produce a fall in the blood carotenoids, and that a deterioration in dark adaptation was undoubtedly associated with a deficiency of vitamin A. It was not, however, possible to reproduce many of the signs which have been held to indicate this—hyperkeratosis, for example, or xerophthalmia. Two of the subjects developed tuberculosis during the course of the experiment, and one would give a great deal to know if the disease could have been caused by the deficiency, but the authors refrain from drawing any conclusions. After reviewing all the available information the authors state guardedly that the vitamin A requirement of man may be about 2,500 i.u. per day and of carotene 7,500 i.u.

The word "heroic" can be overdone, but these experiments almost justify it, and similar ones are not likely to be made for some time. The medical world is indebted to these twenty-three men and women who acted so gamely as the subjects, to the large numbers of clinical and laboratory investigators, and particularly to the two authors, who gave up so much of their time to a problem from which they could hope to gain little, if any, personal reward.

R. A. McCance

## 1523 Textbook of Practical Pharmacognosy

Brian E. Hébert & Kenneth W. Ellery. London: Baillière, Tindall & Cox, 1948. xii + 372 pages; 331 figures. 22 x 14 cm. £1 1s. [£1.05]

(i) The seeds. General method of examination; (ii) subterranean structures. General method of examination; (iii) the leaves and herbs. Preparation and examination; (iv) the barks. General method of examination; (v) the woods; (vi) the flowers. General method of examination; (vii) the fruits. General method of examination; (viii) the insects; (ix) the unorganised drugs. General method of examination; (x) the starches; (xi) surgical dressings; (xii) filtering materials; (xiii) numerical estimations. Appendix: reagents. Index.

"Textbook" is perhaps rather a misnomer for this work. "Handbook" would be a more accurate description, and as a handbook of practical pharmacognosy it can be thoroughly recommended. The authors, in their preface, have accurately described the purpose of their joint effort: "No attempt has been made to present a complete course on the subject, only to assist the student in following and developing the practical instruction received in the laboratory." As such an aid to the student the book subserves a most useful function. The arrangement is logical, the text is clear, concise and accurate, and the illustrations are excellent. Indeed, the illustrations are outstanding in their demonstration of how much can be conveyed by simple line drawings. There is a tendency at the present time to assume that colour and elaboration are essential for accurate delineation. The illustrations in this book are a most convincing demonstration of how much more can be shown by an accurate line drawing than by the most complicated of colour processes. This is a book which will appeal to both teachers and taught in schools of pharmacy.

PARTICULARS OF BOOKS REVIEWED IN LEADING ARTICLES OF BOOK-REVIEW SECTIONS AND ELSEWHERE IN THIS NUMBER

The numerals in square brackets are the serial numbers of the articles in which these books are reviewed

[1430] German-English Medical Dictionary

Compiled by F. S. Schoenewald. London: H. K. Lewis & Co. Ltd., 1949. viii + 241 pages. 25 × 19 cm. £1 7s. 6d. [£1.375]

[1436] A Prelude to Modern Science: Being a Discussion of the History, Sources and Circumstances of the 'Tabulae Anatomicae Sex' of Vesalius

Charles Singer & C. Rabin. Cambridge: University Press, 1946. (Publication of the Wellcome Historical Medical Museum.) lxxxvi + 58 pages; 59 illustrations; 6 tabulae. 32 × 24 cm. £2 5s. [£2.25]

(i) Character and purpose of the 'Tabulae'; (ii) Vesalius and the schools of Louvain and Paris; (iii) Italian predecessors of Vesalius; (iv) Galenic physiology and its Latin presentation; (v) certain anatomical elements in the 'Tabulae'; (vi) Semitic elements in the 'Tabulae'; (vii) general index; (viii) Greek index; (ix) plates: facsimile of the 'Tabulae'.

[1437] The Development of Modern Medicine: an Interpretation of the Social and Scientific Factors Involved

Richard Harrison Shryock. London: Victor Gollancz Ltd., 1948. xi + 384 pages. 22 × 14 cm. £1 1s. [£1.05]

(i) First attempts to establish a physical science, 1600-1700; (ii) the partial failure of physical science, 1700-1800; (iii) social factors in medical lag after 1700; (iv) renewed progress towards an objective science, 1750-1800; (v) early contributions of physic and physicians to the public welfare, 1750-1800; (vi) science in a romantic age, 1800-1850; (vii) medicine and "the basic sciences"; (viii) medicine, mathematics, and the social sciences; (ix) the emergence of modern medicine, 1800-1850; (x) the influence of French medicine in Europe and America; (xi) modern medicine in Germany, 1830-1880; (xii) medicine and the public health movement, 1800-1880; (xiii) public confidence lost; (xiv) the triumphs of modern medicine, 1870-1900; (xv) further progress and some of the consequences; (xvi) public confidence regained; (xvii) a delayed advance against mental disease; (xviii) practice in a changing society, 1880-1930; (xix) American experience; (xx) some contemporary questions. Index.

[1438] An Account of the Schools of Surgery, Royal College of Surgeons, Dublin, 1789-1948

J. D. H. Widdess. Edinburgh: E. & S. Livingstone Ltd., 1949. 107 pages; 16 plates. 25 × 17 cm. 17s. 6d. [£0.875]

[1458] Text-Book of Ophthalmology. Vol. IV. The Neurology of Vision: Motor and Optical Anomalies

W. Stewart Duke-Elder. London: Henry Kimpton, 1949. xxiv + 1155 pages; 1081 illustrations. 25 × 17 cm. £3 10s. [£3.5]

The neurology of vision. (i) The visual pathways; (ii) disorders of the higher visual centres; (iii) anomalies of the pupillary pathways. Motor anomalies of the eyes. (iv) Anomalies of the ocular movements; (v) anomalies of binocular fixation; (vi) concomitant squint; (vii) nonconcomitant squint; (viii) ocular deviations; (ix) pathological nystagmus. Optical anomalies of the eye. (x) Errors of refraction; (xi) anomalies of accommodation; (xii) aniseikonia; (xiii) eye-strain and visual hygiene; (xiv) clinical optical appliances. Index.

[1477] Report of the Working Party on Midwives

Ministry of Health, Department of Health for Scotland & Ministry of Labour and National Service. London: His Majesty's Stationery Office, 1949. viii + 132 pages. 24 × 15 cm. 2s. 6d. [£0.125]

(i) The historical background; (ii) the facts; (iii) the midwife's place in the health team; (iv) the midwife's training; (v) pay and promotion; (vi) working and living conditions; (vii) recruitment; (viii) legal and administrative considerations; (ix) the midwife's work. Appendices: (i) notes on methods and results of surveys; (ii) midwives in the domiciliary and hospital service in England and Wales; (iii) midwives in the Scottish domiciliary service; (iv) midwives' dissatisfaction with their conditions of service; (v) age at entry into the midwifery profession in England and Wales; (vi) supplementary statistical tables; (vii) list of organisations that have given assistance. Index.

[1483] Neonatal Mortality and Morbidity

Joint Committee of the Royal College of Obstetricians and Gynaecologists and the British Paediatric Association. (Reports on Public Health and Medical Subjects, No. 94.) London: His Majesty's Stationery Office, 1949. 92 pages. 24 × 15 cm. 1s. 6d. [£0.075]

(i) Preliminary considerations including: (a) definitions; (b) conditions pertaining to the placenta and membranes; (c) maternal health—social and economic factors; (d) of the newborn; (e) medical and nursing care of the newborn; (f) prematurity and immaturity; (g) diseases of the newborn; (h) general recommendations. Index of authors and sources.

[1491] The Incorporated Liverpool School of Tropical Medicine. Annual General Meeting, December 6th, 1948

Liverpool School of Tropical Medicine. Liverpool: Liverpool School of Tropical Medicine [1949]. 16 pages. 21 × 13 cm.

[1491] Report of the Work of the School for the Year 1947-1948

London School of Hygiene and Tropical Medicine. London: London School of Hygiene and Tropical Medicine, 1949. 138 pages; 4 plates; illustrations. 22 × 14 cm.

(i) Introductory letter; (ii) Ronald Ross; (iii) tropical medicine, 1899-1949; (iv) administration; (v) staff; (vi) report by the Dean, including departmental reports; (vii) list of donations and subscriptions. Appendices: I. Publications. II. Statistics relating to students.

[1496] Trois Journées pour l'Étude Scientifique du Vieillissement de la Population, 22-23-24 Avril 1948. Compte Rendu Complet. Vols. 1-5

Alliance Nationale contre la Dépopulation. Paris: Alliance Nationale, 1948. Vol. 1: 115 pages. 24 × 16 cm. Vol. 2: 133 pages. 24 × 16 cm. Vol. 3: 139 pages. 24 × 16 cm. Vol. 4: 119 pages. 24 × 16 cm. Vol. 5: 78 pages. 24 × 16 cm. 50 fr. per volume

...ours prononcés aux séances  
...ne du vieillissement devant la  
...sociologie. Vol. 2: Travaux  
...de la Section du Vieillisse-  
...sur la biologie de la sénés-  
...politique et de la Section des  
Etudes diverses. Vol. 5: Travaux de la Section de l'Organisation du travail.

## PARTICULARS OF BOOKS REVIEWED ELSEWHERE

- [1496] Proceedings of the International Congress on  
Population and World Resources in Relation  
to the Family, August 1948. Cheltenham,  
England

London: published for the Family Planning Association of Great Britain by H. K. Lewis & Co. Ltd. [1949] xviii ÷ 246 pages. 22 x 14 cm. 10s. 6d. £0.525]

- [1496] Population Policy in Great Britain. A Report  
by PEP

London: PEP (Political and Economic Planning), 1948.  
227 pages. 25 x 19 cm. 15s. [£0.75]

**Part I. Facts and their interpretation.** (i) Survey of world population; (ii) population in Great Britain; (iii) the great increase in parenthood. **Part II. Aims and means.** (iv) The need for a population policy; (v) the principles of a population policy. **Part III. Migration.** (vi) *Emigration and immigration.* **Part IV. The qualitative aspect.** (vii) Making the most of the population; (viii) innate characteristics. **Part V. Clearing the way for larger families.** (ix) Environmental improvements; (xi) the cost of parenthood; (xii) housing; (xiii) the new attitude to the family; (xiv) administration and research. **Index.**

- [1496] Royal Commission on Population. Report

London: His Majesty's Stationery Office, 1949. (Cmd. 7695.) xii + 259 pages. 24 x 15 cm. 4s. 6d. [£0.225]

d of population. (i) The past growth of the determining the trend of population; (iii) the d involuntary causes; (iv) causes of family in births; (vi) the question of replacement; The future concerning future national income; Part II. Population and the : (x) the age balance; (xi) migration; (xii) imponderables and conclusions. Part III. Trend of population and the family. (xiii) Position of the family; (xiv) differential fertility; (xv) aims and scope of proposals; (xvi) financial issues and proposals; (xvii) family services; (xviii) health services; (xix) housing; (xx) public opinion and the family; (xxi) population research. Part IV. (xxii) Summary and general conclusion. Appendices.

- [1506] The Chemistry of Penicillin

Report on a Collaborative Investigation by American and British Chemists under the Joint Sponsorship of the Office of Scientific Research and Development, Washington, DC., and the Medical Research Council, London

Edited by *Hans T. Clarke, John R. Johnson & Robert Robinson*.  
Princeton, New Jersey: Princeton University Press;  
London: Geoffrey Cumberlege, Oxford University Press,  
1949. x + 1094 pages; illustrations. 28 x 20 cm. £9 9s.  
[£9.45]

(i) Brief history of the chemical study of penicillin, by Hans T. Clarke, John R. Johnson, & Robert B. Woodward, "Penicillin: chemistry, immunology, and pharmacology," 2, 3.

(ii) the earlier investigations relating to 2-pencillin, W. Baker, W. R. Boon, C. T. Calam, H. C. Lorey, G. G. Freeman, R. Robinson & A. G. Amylpenicillin up to December 1943, by A. H. Cook & I. M. Heilbron ; (iii) status of the research on the structure of benzylpenicillin in December 1943, by Robert L. Peck & Karl Folkers ; (iv) isolation and characterization of the various penicillins, by O. Wintersteiner, W. R. Boon, H. C. Carrington, D. W. MacCorquodale, F. H. Stodola, J. L. Wechtel, R. D. Coghill, W. C. Risser, J. E. Philip & O. Touster ; (v) penilloic acids and penillamines, by A. H. Cook ; (vi) review of certain investigations on the structure of benzylpenicillin during 1944-1945, by Robert L. Peck & Karl Folkers ; (vii) some inactivation and degradation reactions not included in chapters iv and vi, by O. Wintersteiner, H. E. Stavely, J. D. Dutcher & M. S. Spielman ; (ix) desethoxybenzylpenicillin and other hydrogenolysis products of benzylpenicillin, by Edward Kaczka & Karl Folkers ; (x) the thioacetate derivative of benzylpenicillin methyl ester, by Vincent du Vigneaud & Donald B. McElville ; (xi) the X-ray crystallographic investigation of the structure of penicillin, by D. Crowfoot, C. W. Bunn, B. W. Rogers-Low & A. Turner-Jones ; (xii) identification and crystallography of penicillins and related compounds by X-ray diffraction methods, by G. L. Clark, W. I. Kaye, K. J. Pipenberg & N. C. Scheltz ; (xiii) infrared spectroscopic studies on the structure of penicillin, by H. W. Thompson, R. R. Bratman, H. M. Randall & R. S. Rasmussen ; (xiv) other physical methods, by R. B. Woodward, A. Neuberger & N. R. Trenner ; (xv) the constitution of penicillins, by John R. Johnson, Robert B. Woodward & Robert Robinson ; (xvi) penicillamine, its analogs and homologs, by Harry M. Crooks ; (xvii) penilloaldehydes and penaldic acids, by Ellis V. Brown ; (xviii) the penillole and penillole acids and their derivatives and analogs, by Ralph Mozingo & Karl Folkers ; (xix) biosynthesis of penicillins, by Otto K. Behrens ; (xx) chemical modifications of natural penicillins, by R. D. Coghill, F. H. Stodola & J. L. Wechtel ; (xxi) oxazoles and oxazolones, by J. W. Cornforth ; (xxii) penicillins containing side chains derived from amino acids, by W. E. Bachmann & M. W. Cronyn ; (xxiii) penicillins containing side chains derived from amino acids and d-penicillamine and the resultant penicillins, by J. L. Wood & M. E. Wright ; (xxiv) methyl penicillaseuropenicillinate, by J. H. Hunter, J. W. Hinman & H. E. Carter ; (xxv) thiazolidines, by A. H. Cook & I. M. Heilbron ; (xxvi) the chemistry of  $\beta$ -lactams, by S. A. Ballard, D. S. Melstrom & C. W. Smith ; (xxvii) the  $\gamma$ -lactam of benzylhomopenicilloic acid and related compounds, by Vincent du Vigneaud & Frederick H. Carpenter ; (xxviii) synthetic benzylpenicillin, by Vincent du Vigneaud, Frederick H. Carpenter, Robert W. Holley, Arthur H. Livorn & H. B. ; (xxix) assay of penicillins, by John V. Scudi & ; (xxx) index.

# Shorter Notices

## Basic Principles of Ventilation and Heating

Thomas Bedford. London: H. K. Lewis & Co. Ltd., 1948. x + 401 pages; 123 illustrations. £1 5s. [£1.25]

The present work is an expansion of the author's previous *Modern principles of ventilation and heating*, published in 1937. The title is to be taken very literally, since the "purpose in preparing this volume has been to deal with ventilation and heating in terms of basic human needs". As such, it should prove of considerable value to public health and industrial medical officers and is well calculated to give them much valuable information without detailed discussion of engineering practice.

D. T. R.

## Understand your Diabetes. A Guide-book for the Diabetic Patient

John W. Coldwell. Toronto: Oxford University Press; London: Geoffrey Cumberlege, 1949. xv + 146 pages; illustrations. 18 x 13 cm. 7s. 6d. [£0.375]

This short manual joins the many designed to smooth the path of the diabetic patient. Originally written for his own patients, the book reflects the views of a younger man who none the less has had a considerable experience with the disease. In clear but not over-simplified language it sets out the elements of the pathological physiology of the disease and its complications; there follows a considerable discussion of its treatment, diabetic hygiene, complications and dietary hints. It perhaps errs on the side of bluntness in describing the various complications, but it may be that the armour of truth is, in the end, most satisfactory. The book should answer all or nearly all the questions which a diabetic patient is likely to ask his physician.

D. F.

## Occupational & Physio-Therapy: Scope, Training and Prospects

R. H. Finnegan. London: Actinic Press, 1948. 127 pages; 5 plates. 19 x 13 cm. 6s. [£0.3]

This book contains descriptions of the "scope, training and prospects" of occupational therapy and physiotherapy, the major part of the text being given to occupational therapy since, as the author remarks, this is a less widely known profession in Britain.

The section on occupational therapy is sadly misleading—sadly, because, though some of the matter is correct, it is very "popularly" written. It misses the more real and serious implications of the work, and refers to that which should be a scientific and expert treatment in superficial and expansive terms. The physiotherapy section contains many inaccuracies such as the inclusion of physical training colleges in the list of recognized schools and the statement that the starting salary of a physiotherapist "in accordance with the Rushcliffe award is £362". Also, the inclusion of a hyphen in physiotherapy may be a personal foible of the author's, but it is surely inexcusable to mis-spell the name of the Chartered Society of Physiotherapy.

The book is presumably intended for prospective students. The descriptions of the work done by occupational therapists and physiotherapists would certainly be of interest to young people who are deciding on a career. It does, however, seem useless

to publish in book form full details about training schools and examinations which are constantly changing and can be accurately obtained only from the professional associations concerned.

M. Williams & E. M. Macdonald

## Public Health and Social Services. An Elementary Textbook for Midwives

D. H. Geffen & L. Farrer-Brown. Third edition. London: Edward Arnold & Co., 1949. 123 pages. 19 x 12 cm. 5s. [£0.25]

This small book was specially written for midwives, and it is therefore not surprising that it deals chiefly with that aspect of public health with which midwives are concerned. It presents the basic information which all who are actively engaged in the field should have. The present edition brings the volume up to date and includes reference to the recent legislative changes which have had such far-reaching effects.

D. F.

## Techniques in Physiotherapy

Edited by F. L. Greenhill. London: Hodder & Stoughton Ltd., 1948. x + 222 pages; 37 illustrations. 22 x 14 cm. 12s. 6d. [£0.625]

The author states in her preface that "the present volume is an effort to present, in as practical a way as possible, some of the newer concepts of physical methods and their application to the problems of rheumatism and other medical and surgical ailments." The book is designed to provide the practising physiotherapist with a selected number of techniques that have successfully passed the hard test of actual practice. Dr. Greenhill is assisted by Dr. Heald in the chapter on rheumatism and arthritis, by Mr. Barron in that on burns and injuries of the hand, and by Mr. Colson in that on occupational therapy. Dr. Bowden undertook the section on peripheral nerve lesions and Miss Finlayson is largely responsible for that on techniques in chest conditions. There are also chapters on exercises and games for small groups, exercises for abdominal conditions, suspension therapy, complications following trauma, some specialized methods in physiotherapy, and medical practitioners and physiotherapy. Only a few of the techniques employed in orthopaedic clinics are included, since these have been fully described in other books. The conditions are discussed and the reasons for the different techniques are explained.

There are a few statements which this reviewer finds difficult to believe. One, for instance, is that 2-5 mA of direct current may be employed in order to reduce oedema, with the anode distal to an injury, when it cannot be applied over it, and the cathode on some other part of the body. It seems more likely that the elevation of the limb, which accompanies this treatment, is responsible for the reduction of oedema. Another such statement is that surged sinusoidal current, applied locally by means of padded electrodes, produces painless muscle contractions.

Physiotherapists will find much valuable information in this book. It should also interest specialists in physical medicine.

E. B. Clayton

## An Introduction to Pharmacology and Therapeutics

J. A. Gunn. Eighth edition. London: Geoffrey Cumberlege, Oxford University Press, 1948. ix + 301 pages. 8s. 6d. [£0.425]

The author of this Introduction is Chairman of the British Pharmacopoeia Commission; previous

editions have already established the great usefulness of the book. The 8th edition contains new sections on chemotherapy, penicillin, sex hormones and blood coagulation, and the whole has been revised to conform with the 1948 *British Pharmacopoeia*.

D. T. R.

## Artificial Pneumothorax in Pulmonary Tuberculosis

T. G. Heaton. Toronto: The Macmillan Company of Canada Limited, 1947. xvi + 292 pages; 3 figures. 21 x 14 cm. £1

The author has had many years of experience in tuberculosis and diseases of the chest in civilian life, in the Canadian Army, and now as clinician in charge of the chest service at a large war veterans' hospital in Toronto. This book summarizes his experience in the use of artificial pneumothorax; it describes the history of this technique, the physiological principles upon which it is based, the indications for its use, and the management and treatment of the complications which may arise. There is a very full bibliography at the end of each chapter, and the book represents a fairly comprehensive review of the literature dealing with artificial pneumothorax. There are also chapters on extrapleural pneumothorax, oleothorax and pneumoperitoneum. It should prove of great value to all those concerned with the long-term care of tuberculous patients.

D. F.

## Pasteurisation

Horry Hill. Second edition. London: H. K. Lewis & Co. Ltd., 1947. viii + 296 pages; 73 illustrations. £1 1s. [£1.05]

The aim of the author has been to emphasize the need for efficient pasteurization of milk and to provide a thorough understanding of the methods to be employed. It is unfortunate that the production of a 2nd edition was not made the occasion for a more drastic revision of the text. No doubt much useful information is embedded in it, but the style certainly militates against the better understanding of the subject which the author desires.

D. T. R.

## The Sulphonamides in General Practice

Edward D. Hoore. London: Staples Press, 90 pages. 17 x 10 cm. 5s. [£0.25]

This volume should be a useful addition to the literature of general practice; it gives in very clear and brief form the necessary information which should direct the chemotherapeutic volleys fired by the general practitioner. So guided, the practitioner should be in a position to avoid blind prescribing, and should rarely be baffled by the non-response of a case to sulphonamide therapy. It is perhaps debatable that the sulphonamides and penicillin are both equally effective in bronchopneumonia (page 73). Surely the relative non-toxicity of penicillin favours its use? In general, however, the author follows orthodox teaching in presenting the relative merits of the two agents. Perhaps a further volume dealing more extensively with other antibiotics and covering the whole field of chemotherapy and antibiotics for the general practitioner will be forthcoming; such a volume, written with the same clarity and concision, would be extremely useful.

D. F.

## Food and the Principles of Dietetics

Robert Hutchison. Revised by V. H. Mottram & George Graham. Tenth edition. London: Edward Arnold & Co., 1948. xxvii + 727 pages. 22 x 14 cm. £1 1s. [£1.05]

Eight years have passed since the last edition of this standard textbook. Despite much condensation, the book runs to 70 extra pages, owing to the advances in the science of nutrition made during and since the war.

Part I, "Diet in normal life", has been rewritten. The wide variation in intake which is compatible with health receives attention, and a salutary warning is given against attempts to fit the individual to the average requirements of the community. The dynamic concept of protein is lucidly set out, but this can hardly be said for the arguments which back the recommendation of 37 g. of first-class protein daily for the average adult male. Part II, "The nature of foods", has been compressed and rearranged, and there are many changes in Part III, "The principles of feeding in infancy and childhood" (by Charles Harris) and in Part IV, "Diet in the treatment of disease", where much that is needed in general practice is conveniently set out.

The book is a thoroughly useful one both for practitioners and dietitians.

W. T. C. Berry

### The Diabetic ABC. A Practical Book for Patients and Nurses

R. D. Lawrence. Tenth edition. London: H. K. Lewis & Co. Ltd., 1948. vii + 80 pages. 4s. [£0.2]

In the preface to the 1st edition, published in 1929, the author said his book contained what he would like to teach every patient if he had enough time. Through the many editions and reprints many patients have been so taught. This 10th edition renews the value of the work by the inclusion of fresh recipes "included to try to vary the general dullness" occasioned by the post-war food situation. The whole work presents a practical guide based on the author's "line diet" system.

D. T. R.

### The National Health Service

Prepared by the Ministry of Health & the Central Office of Information. London: His Majesty's Stationery Office [1949]. 36 pages. 22 x 14 cm. 6d. [£0.025]

At last we have an official presentation of the National Health Service, designed for the layman. This pamphlet describes why and how the Service came into being, outlines its administration, and states the benefits available under it. Reasonably enough, the pamphlet is non-controversial, and the wisdom or non-wisdom of the scheme is never questioned. The advantages to the layman are sufficiently emphasized: the various points of friction with the medical profession are not aired. Nor is the latter to be expected in such a pamphlet. It is well written and deserves to be widely read. A useful diagram sets out the administrative structure of the Service; this should help to clarify in the layman's mind the function of the various bodies which operate under it.

D. F.

### The Nuffield Foundation. Report of the Trustees for the Year Ending 31 March 1949

The Nuffield Foundation. Oxford: University Press, 1949. 127 pages. 22 x 14 cm.

At a time when the increasing domination of the State, combined with high taxation, threatens to dry up the springs of private philanthropy which have, in the past, been such a source of strength to academic and scientific workers, it is refreshing to

read such a Report. Clearly, Viscount Nuffield has realized the immense power for good which benefactions on such a scale as his are capable of wielding. The Nuffield Foundation has availed itself of the very best expert advice, and the result is that its benefactions are at once effective and efficient. Almost no branch of medical science has not benefited; the present Report is an inspiring record of progress, and it illuminates the various pressing problems which assail our time, not only in the field of medical science but also in the vast territories of other natural sciences and general social welfare.

D. F.

### Anaesthetics and the Patient

Gordon Ostlere. London: Sigma Books Ltd., 1949. (Sigma Introduction to Science, 15.) 166 pages; 4 plates; 6 figures. 19 x 12 cm. 7s. 6d. [£0.375]

In *Anaesthetics and the patient* Dr. Gordon Ostlere has set himself the task of stimulating and holding the layman's interest in a highly technical subject without, as he says, talking either down to his readers or above their heads. He seems to have succeeded remarkably well. His book gives a clear and simple picture of current anaesthetic practice, set in perspective by short historical interpellations indicating the main lines along which anaesthesia has progressed during its first hundred years.

Dr. Ostlere is particularly good at making the action of anaesthetics in the human body appear understandable; and his descriptions of such special procedures as the use of curare, controlled respiration in thoracic surgery, and anaesthesia in childbirth, are vivid and interesting. But he occasionally nips a finger in that trap set especially for experts: he tends to over-estimate the general reader's ability to comprehend the working of machines (for example, flowmeters) from short verbal descriptions, and to underrate his general knowledge—"Fish obtain oxygen from the water in which they swim, and flowers and plants, too, require oxygen for survival."

It is surely right to consider the history of anaesthesia a fascinating story, and Dr. Ostlere has chosen his illustrative excerpts with discrimination, but he sometimes seems on uneasy terms with the protagonists. The first specialist anaesthetist was "known as John Snow" because that was his name, but Hewitt, who among other important things devised an airway, was probably not often "called Hewitt." Nor was Snow "a pupil of the famous anatomist and surgeon, John Hunter," for when Snow attended the Hunterian School of Medicine, in Windmill Street, London, Hunter himself was long since dead.

But such small inaccuracies, and occasional repetitions, do not seriously detract from a book which came to be written because its author wished above everything "to help the nervous patient to face his operation in a better state of mind," for, as he says, "it is now the anaesthetic that has come to be feared rather than the surgical procedure itself." One may think that Dr. Ostlere over-simplifies when he claims that "knowledge does more than give courage, it removes the bogey itself," but his exposition of the nature of anaesthesia and the duties of the anaesthetist towards his patient certainly ought to reassure the man-in-the-street. Nevertheless the timid reader may do well to pass over Plate IV. This shows an abdomen being opened under light anaesthesia, with and without curare, and although it is very indistinct it is also very suggestive of gruesome detail.

Barbara M. Duncum

### Textbook for Midwives

Wilfred Shaw. London: J. & A. Churchill Ltd., 1948. viii + 689 pages; 223 illustrations. 19 x 13 cm. 12s. 6d. [£0.625]

This new textbook is based on the recognition of the increased importance and improved status of the midwife. "The book is intended for serious students who have a real and intelligent interest in midwifery" and is the outcome of the author's practical experience in training pupil midwives. It thus offers a much wider and fuller exposition of its subject than has been the case with the majority of such works in the past. The price is most reasonable for a well-illustrated book of such length.

D. T. R.

### Foods: their Values and Management

Henry C. Sherman. New York: Columbia University Press, 1945. viii + 221 pages. 22 x 14 cm. \$3.25

"Food management" is the technique of making the best use of food production and distribution to satisfy nutritional needs" and though Professor Sherman is dealing with the production of food in the USA he bears in mind the nutritional needs of the rest of the world. The book deals with the relation of food production to nutrition, not only from the view-point of those concerned with the food policies of nations, but also of the average American consumer whose demands influence agricultural production to a large degree. It aims to guide the consumer to a more informed selection of his food, for example, by an increased consumption of milk rather than meat, and by the acceptance of grass-fed beef. By moves such as these the consumer's diet will more closely approach optimal standards, and more land will become available to satisfy the needs both of the poorer sections of the American public and of other countries. Written by so high an authority this book should do good.

W. T. C. Berry

### Midwifery: by Ten Teachers

Edited by Clifford White, Frank Cook & William Gilliett. Eighth edition. London: Edward Arnold & Co., 1948. viii + 360 pages; 217 figures. 22 x 14 cm. £1

This work has earned its reputation not so much as a series of individual contributions as a consensus of authoritative opinion. A different section has been allocated to each author for thorough revision, but "only on occasion has it been necessary to accept the views of a majority." In this edition H. G. E. Arthur, A. C. H. Bell and F. W. Rogers are among the authors.

D. T. R.

### Human Physiology

F. R. Winton & L. E. Bayliss. Third edition. London: J. & A. Churchill Ltd., 1948. xv + 592 pages; 243 illustrations. 24 x 15 cm. £1 5s. [£1.25]

This 3rd edition appears after an interval of 12 years. It is designed for the medical student of physiology, not so much to include all the accepted facts as to encourage "the intellectual attitude of an alert explorer". The temptation, ever present in revision, to enlarge the work beyond the limits of a small textbook, has been resisted. As in the 2nd edition, a number of collaborators has been invited to make contributions in their special fields under the guiding influence of the original authors, but, since this influence is exerted throughout, there is no sense of disjointedness and a consistent standard is maintained.

D. T. R.



# Books Received

May 1949—August 1949

Reviews of many of these books appear in this number of the Bulletin or will appear in future numbers

Abellán Ayala, A. *Pancreopatas agudas no dramáticas. (Aspectos diagnósticos.)* Vols. 1 & 2. (Colección Española de Monografías Médicas.) 1949. Ediciones BYP (Barcelona), 20 ptas each volume

Aimard, J. & Dausset, H. *L'ultra-violet : la lumière solaire et artificielle. L'infus-ronge.* 7th ed., by H. Aimes & P. Betoulières. 1949. L'Expansion Scientifique Française (Paris)

Allen, C. *Modern discoveries in medical psychology.* 2nd ed. 1949. Macmillan (London), 12s. 6d. [£0.625]

*Analgesia in Childbirth Bill.* 1949. His Majesty's Stationery Office (London), 2d. [£0.008]

*Annual Review of Physiology.* Vol. 11. 1949. Annual Reviews (Stanford, California), 5s

Association of British Chemical Manufacturers. *British chemicals and their manufacturers. The directory of the Association of British Chemical Manufacturers (Incorporated).* 1949. Association of British Chemical Manufacturers (London)

Bailey, H. *Emergency surgery.* Parts I & II. 6th ed. 1948. Wright (Bristol), £1 1s. each part [£1.05]

Bailey, H. & Love, R. J. M. *A short practice of surgery.* Part V. 8th ed. 1949. Lewis (London), £2 12s. 6d. the set of five parts [£2.625]

Bentley, A. O. *Text-book of pharmacutics.* 5th ed., revised by Harold Davis, with the collaboration of M. W. Partridge & A. I. Robinson. 1949. Baillière (London), £1 10s. [£1.5]

Bergin, K. G. *Aviation medicine : its theory and application.* 1949. Wright (Bristol), £1 15s. [£1.75]

Bertwistle, A. P. *A descriptive atlas of radiographs : an aid to modern clinical methods.* 7th ed. 1949. Kimpton (London), £2 10s. [£2.5]

British Council for the Welfare of Spastics. *Notes for parents on the home care of children handicapped by cerebral palsy.* 2nd ed. 1949. British Council for the Welfare of Spastics (London), 1s. 3d. [£0.0625]

British Medical Association. *The criminal law and sexual offenders. A report of the Joint Committee on Psychiatry and the Law appointed by the British Medical Association and the Magistrates' Association.* 1949. British Medical Association (London), 3d. [£0.0125]

British Pharmacopoeia Commission. *A general survey of the British Pharmacopoeia 1948.* (A series of lectures by members of the British Pharmacopoeia Commission, 1933-1948, and other authorities.) [1949] Pharmaceutical Press (London), 5s. 6d. [£0.275]

British Red Cross Society. *Report of the British Red Cross Society for the year 1948.* 1949. British Red Cross Society (London)

British Red Cross & Order of St. John of Jerusalem. *Red Cross & St. John. The official record of the humanitarian services of the War Organisation of the British Red Cross Society and Order of St. John of Jerusalem, 1939-1947.* Compiled by P. G. Cambray & G. G. B. Briggs. 1949. British Red Cross & Order of St. John of Jerusalem (London), not for public sale

Brown, J. A. C. *The distressed mind. An outline of psychiatry.* (The Thinker's Library, No. 115.) 2nd ed. 1949. Watts (London), 2s. 6d. [£0.125]

Browning, C. H. & Mackie, T. J. *Textbook of bacteriology. (Eleventh edition of Muir & Ritchie's "Manual.")* 1949. Geoffrey Cumberlege, Oxford University Press (London), £2 10s. [£2.5]

Cade, S. *Malignant disease and its treatment by radium.* Vols. 1 & 2. 2nd ed. 1948 & 1949. Wright (Bristol), £2 12s. 6d. each volume [£2.625]

Caldwell, J. W. *Understand your diabetes. A guide-book for the diabetic patient.* 1949. Oxford University Press (Toronto); Geoffrey Cumberlege (London), 7s. 6d. [£0.375]

Carleton, H. M. & Leach, E. H., editors. *Schafer's essentials of histology, descriptive and practical. For the use of students.* 15th ed. 1949. Longmans, Green (London), £1 5s. [£1.25]

Central Council for the Care of Cripples. *Local voluntary associations for the physically handicapped. Part I : Formation and aims. Part II : Provisions of recent legislation.* [no date] Central Council for the Care of Cripples (London), 2s. [£0.1]

Chabrol, E. & Fallot, P. *La pénicilline en pathologie hépatique.* 1949. Masson (Paris), 350 fr.

Cheymol, J., Danielopolu, D., Hazard, R., La Barre, J., Lespagnol, A. & Valette, G. *Actualités pharmacologiques.* Publiées sous la direction de René Hazard. Première série. 1949. Masson (Paris), 500 fr.

Chief Inspector of Factories. *Annual report of the Chief Inspector of Factories for the year 1947.* (Cmd. 7621.) 1949. His Majesty's Stationery Office (London), 2s. 6d. [£0.125]

Children's Reception Centre, Merham, Kent. *Interim report 1948.* [no date] Children's Reception Centre (Merham, Kent), 1s. 6d. [£0.075]

Clarke, H. T., Johnson, J. R. & Robinson, R., editors. *The chemistry of penicillin.* 1949. Princeton University Press (Princeton, New Jersey); Geoffrey Cumberlege (London), £9 9s. [£9.45]

Clayton, E. B. *Electrotherapy and actinotherapy.* 1949. Baillière (London), 12s. 6d. [£0.625]

Cole, G. D. H. *British social services.* 1948. Published for the British Council by Longmans, Green (London), 1s. [£0.05]

Cournand, A., Baldwin, J. S. & Himmelstein, A. *Cardiac catheterization in congenital heart disease. A clinical and physiological study in infants and children.* 1949. Commonwealth Fund (New York); Geoffrey Cumberlege, Oxford University Press (London), £1 2s. [£1.1]

Cummins, S. L. *Tuberculosis in history. From the 17th century to our own times.* 1949. Baillière (London), £1 1s. [£1.05]

Cunningham, D. J. *Manual of practical anatomy. Vol. 2 : Thorax and abdomen.* 11th ed., revised and edited by James Couper Brash. 1948. Geoffrey Cumberlege, Oxford University Press (London), £1 1s. [£1.05]

Cunningham, D. J. *Manual of practical anatomy. Vol. 3 : Head and neck : brain.* 11th ed., revised and edited by James Couper Brash. 1948. Geoffrey Cumberlege, Oxford University Press (London), £1 1s. [£1.05]

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Department of Scientific and Industrial Research. *Methods for the detection of toxic gases in industry. Leaflet No. 7 : Carbon monoxide.* 1939 (reprinted 1948). His Majesty's Stationery Office (London), 3s. [£0.15]

Duke-Elder, W. S. *Text-book of ophthalmology. Vol. IV. The neurology of vision. Motor and optical anomalies.* 1949. Kimpton (London), £3 10s. [£3.5]

East, N. *Society and the criminal.* (Home Office, 1949. His Majesty's Stationery Office (London), 10s. [£0.5]

Evans, F. T., editor. *Modern practice in anaesthesia* 1949. 1949. Butterworth (London), £2 10s. [£2.5]

Faris, D. W. G. *Annual report of the King Edward VII College of Medicine, Singapore, for the year 1947.* 1949. Government Publications Bureau (Singapore), \$1.50

Farquharson, E. L. *Illustrations of surgical treatment : instruments and appliances.* 3rd ed. 1949. Livingstone (Edinburgh), £1 5s. [£1.25]

Foot Health Educational Bureau. *Foot inspection in childhood and adolescence. Suggestions made for the assistance of school medical officers in examining children's feet.* 1949. Foot Health Educational Bureau (London), 1s. [£0.05]

Foot, R. R. *Varicose veins.* 1949. Butterworth (London), £1 12s. 6d. [£1.625]

Friel, A. R. *Zinc ions in ear, nose, and throat work.* 1948. Wright (Bristol), 5s. 6d. [£0.275]

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Glover, E. *Psycho-analysis. A handbook for medical practitioners and students of comparative psychology.* 2nd ed. 1949. Staples Press (London), 15s. [£0.75]

Greenhill, F. L., editor. *Techniques in physiotherapy.* 1948. Hodder & Stoughton (London), 12s. 6d. [£0.625]

Groves, E. W. H. & Fortescue-Brickdale, J. M. *Text-book for nurses : anatomy, physiology, surgery and medicine.* 7th ed., revised by J. A. Nixon & Cecil Wakeley. 1948. Geoffrey Cumberlege, Oxford University Press (London), £1 10s. [£1.5]

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Hill, C. & Woodcock, J. *The National Health Service.* 1949. Christopher Johnson (London), 16s. [£0.8]

Hill, H. & Dodsworth, F. *Food inspection notes. A handbook for students.* 3rd ed. 1949. Lewis (London), 7s. 6d. [£0.375]

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- Marina Fiol, C. *Estudio radiológico del intestino delgado.* 1949. Editorial Paz Montalvo (Madrid), 190 ptas
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- Medical Research Council. *The physique of young adult males.* By W. J. Martin. (Medical Research Council Memorandum No. 20.) 1949. His Majesty's Stationery Office (London), 1s. 3d. [£0.0625]
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- Ministry of Education. *University awards. The report of the Working Party on University Awards appointed by the Minister of Education in April 1948.* 1948. His Majesty's Stationery Office (London), 9d. [£0.0375]
- Ministry of Health. *Food poisoning. Steps to be taken in England and Wales by medical officers of health in the investigation of food poisoning.* Revised 1949. His Majesty's Stationery Office (London), 3d. [£0.0125]
- Ministry of Health. *Report of the Ministry of Health for the year ended March 31, 1948, including the Report of the Chief Medical Officer on the State of the Public Health for the year ended 31st December, 1947.* (Cmd. 7734.) 1949. His Majesty's Stationery Office (London), 5s. [£0.25]
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## Films

1526

### His Fighting Chance

made at St. Mary's Hospital, Carshalton, Western Fever Hospital, Fulham, and Wingfield Morris Orthopaedic Hospital, Oxford, 1949; a Central Office of Information film; technical advisers, Dr. C. J. L. Wells, Dr. T. Fisher & Dr. W. H. Kelleher; produced by Gordon Smith; directed by Geoffrey Innes; unit, Crown Film Unit; distributed by Central Film Library; available in 35 and 16 mm. sound, 918 feet [280 m.] and 366 feet [112 m.] respectively; monochrome; 10 minutes

This is a 10-minute film which was included in the programmes in 3,000 British cinemas in the autumn of 1949; it is largely made up of material from last year's film "Polio—Diagnosis and Management", which was a 50-minute film for medical audiences. It refers to President Roosevelt, who did not let this illness defeat him, and Mrs. Roosevelt has recorded part of the commentary. The film refers only briefly to diagnosis and deals chiefly with the hospital care and rehabilitation of patients. A two-year-old baby is seen in an early stage and again after a year, still in hospital, still improving; and a young man is shown at the beginning of his illness, at various stages of his recovery, and while training for a new job. The film also shows Mrs. Richmal Crompton, the writer, and an almoner, both working after having triumphed over their illness.

The film was not made specifically to meet the possibility of an epidemic in Great Britain, its object being to reassure the public about this illness by showing the active steps that are being taken in British hospitals to restore patients to good health. It is the first of a new series of films designed to be shown in public cinemas. Not all will be on health; others will deal with various scientific and technical subjects, but all will have a similar approach. It is admittedly difficult to say much about a technical subject in a 10-

minute film but these films will make themselves more easily remembered if they explain more about the background of the problems. "His Fighting Chance", for example, could not deal with methods of diagnosis but it could have explained that the nerves to some muscles are damaged by the acute illness; that many of these damaged nerves may quickly recover completely if not overtaxed, and that the remainder are encouraged and helped to recover by the graduated exercises shown. However, the film conveys well the importance of keeping up the patient's morale, and the cheerfulness of a small boy (aged 3), after a year in hospital, is indeed inspiring. In its standard of production the film will compare favourably with other films appearing in the same programmes, and it is to be welcomed.

R. C. M.

1527

### A Technique of Subcutaneous Hormone Implantation

demonstrated by G. I. M. Swyer; produced by Brian Stanford for Roussel Laboratories Ltd.; obtainable free on application to Roussel Laboratories Ltd., 4 Golden Square, London, W. 1; available in 16 mm. mute, 220 feet [67 m.]; colour; 7 minutes at 24 frames per second

This silent film is designed as a teaching aid, to be shown to postgraduate audiences by a competent lecturer. It shows in very clear detail the rather simple procedure of subcutaneous hormonal implantation via a skin incision. Only the usual surgical instruments are used and the operation, performed under local anaesthesia, is of such simplicity that it should be within the range of any practitioner. The film does not deal with the indications for such hormonal therapy, with the problems of dosage, nor with the results to be expected; this is left to the lecturer, who, as has been said, is indispensable to the proper showing of the film. The film, after all, is designed as a teaching aid. However, the surgical procedure involved is so elementary that this reviewer, at least, wonders if cinematographic presentation is necessary to enable postgraduate students to grasp it.

D. F.

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## Neurophysiology

The communications which are presented here by physiologists and neurologists represent such a wide range of research and offer so much of interest that they may fittingly be introduced by a short review of the more important stages in the development of neurophysiology, a field to which British workers had early made many noteworthy contributions.

In the later years of the last century, attention was particularly focused on the localization of function on the surface of the forebrain, of which there had been no indication till Broca showed that certain functions of speech depend on integrity of a portion of its cortex. It was not, however, till 1870, when Fritsch and Hitzig succeeded in evoking movements of the limbs by stimulation of the cerebral cortex by an electrical current, that the important part which this plays in the higher mammals, and especially in man, was recognized. These observations excited the interest of Ferrier in Great Britain, who, by his early training in physiology and psychology and by his exceptional manual dexterity, was particularly fitted to extend and elaborate them. He succeeded in demonstrating that not only initiation of movement, but also sensation, vision and hearing, are represented in, or related to, separate circumscribed areas of the surface of the forebrain. Confirmation, and in some respects modification, of Ferrier's observations came from his fellow countrymen Horsley, Schäfer, Beever and others ; in fact, during the succeeding twenty years, the chief contributions to this subject by experimental methods were made by the British school.



But even before it had been shown that restricted areas of the cortex are related to certain functions, Hughlings Jackson, whose teaching has had a profound influence on the development of this branch of neurology, had with remarkable insight discussed at length not where functions can be localized, but the more essential problem of how they are represented in the higher levels of the nervous system.

The next milestone in this chapter of neurology was the series of investigations by Grünbaum and Sherrington on the excitable cortex of anthropoid apes. In addition to providing a more precise scheme of localization of motor functions, these investigations showed that the response of any point to electrical stimulation is not constant and unalterable, but varies with varying conditions of stimulation; in other words, the motor cortex is a plastic organ. All subsequent investigations have confirmed Sherrington's conclusions, but as Jefferson in this number points out in his review of recent work, the conviction has been gaining ground that the exclusive role in initiation and direction of movement hitherto generally assigned to the cortical motor area can be no longer admitted. In fact, clinicians as well as physiologists have come gradually to the belief that even the simplest movement, whether it be voluntary, so-called, or evoked by a stimulus, requires the co-operation of cortical and subcortical mechanisms.

Clinical studies have thrown further light on these and other problems, and especially on those for which a co-operative human subject is essential. Noteworthy among these studies are: the distribution and organization of the sensory receiving areas in the cortex; the mode of synthesis of elementary movements into complex purposeful acts; the recognition and identification of happenings in the outer world or in the subject's own body by integration of messages supplied to the brain, and the use of the conventional symbols of speech for communication with one's fellows. But unfortunately conclusions from clinical observations depend mainly on the study of functions that are disordered by disease and their interpretation is frequently difficult, for the symptoms exhibited by a patient, especially when they are due to injury of the higher and less organized levels of the nervous system, are partly the result of adjustment of intact parts to the specific defect; they rarely give a true and simple picture of the function that is lost.

Though less spectacular, studies of the lower levels of the nervous system have been equally essential to an understanding of how the system works as a whole. Earlier investigations on reflexes mediated through the spinal cord

and brain-stem threw much light on the nature of nervous activity of these parts, but it is largely to Sherrington's classical work on the integration of their activities that modern neurology owes its present orientation.

The papers included in this symposium have been contributed by those actively engaged in the study of the subjects on which they write. They deal with almost every branch of neurophysiology, from such fundamental matters as conduction through individual nerve fibres to sensory discrimination at higher levels of the nervous system; from nervous control of the endocrine glands to localization of function in the cerebral cortex.

Much of this has been acquired by the use of new methods which have enabled physiologists to trace and analyze at different levels of the nervous system messages that arrive from the periphery or originate within it. This is well brought out in Eccles' interesting paper on the responses of motoneurons; and Hodgkin's researches on the conduction of impulses, for instance, necessitated the insertion of a fine electrode into a single nerve fibre for the purpose of studying action and resting potentials developed across the membrane on its surface. To observe the effects of stimulation of different parts of the hypothalamus, Harris employed electrodes permanently fixed within it; these could be excited, without interfering with the routine of the experimental animal's life, simply by bringing the animal's head into an electromagnetic field.

All the communications presented here contain matter of special or general interest. The story of the hypothalamus is told from the anatomical side by Le Gros Clark & M. Meyer, and from the physiological side by Harris. The significance of the hypothalamus was for long overlooked, though the fact that its development has scarcely varied in the vertebrate series was suggestive. Now it is recognized as the highest level of the autonomic system. Its intimate reciprocal relations with the cortex enable it, on the one hand, to influence cortical activity itself, and on the other hand to determine the reactions of the ductless glands and other organs to emotional and other higher-level activities.

Another function of the autonomic system is regulation of the flow of blood through different organs. Carmichael, who has already studied it in the distal segments of the limbs, reviews the subject in the light of further observations. In addition to the generally recognized vasoconstrictor reflexes, he finds evidence of vasodilator fibres to arteries, and even that veins, in the peripheries of the limbs at least, may also be under sympathetic control.

Feldberg in a particularly interesting article records experiments which at least suggest that passage of impulses across synapses in the central nervous system may be effected by a chemical transmitter, such as acetylcholine, which Dale has shown to be essential in the autonomic system.

Another noteworthy contribution is Adrian's paper on the basis of sensory discrimination. In addition to a critical review of the subject, he refers to the results of his further studies on the distance receptors, in this instance by experiments on the olfactory system. These show that, as in the case of vision and hearing, recognition and differentiation of a stimulus depends on the characteristic pattern of excitation it forms on the receptor surface.

As facts accumulate it often happens that cherished

theories and assumptions must be disenthroned from positions long accorded them, or at least that they must be greatly modified. Jefferson, for example, here brings forward evidence which, though still scanty, suggests that consciousness, in the sense of awareness of surroundings, which has been almost universally regarded as a function of only the highest levels of the nervous system, may be dependent on integrity of certain structures in the brain-stem. If this evidence becomes generally accepted, it will provide yet another instance of a change of outlook brought about with the help of experimental research.

This symposium shows what a wide range of work of this kind is being carried out now in Britain; future developments in this subject should be equally impressive.

*Gordon Holmes*

# Notes on Contributors

PROFESSOR E. D. ADRIAN has occupied the chair of physiology at Cambridge since 1937, and in 1942 was awarded the Order of Merit. Much of his work has been on the function of neurones and on the use of the electroencephalograph. His most recent book, *The physical background of perception*, was published in 1947; other works include *The basis of sensation* (1928) and *The mechanism of nervous action* (1932). In 1945 Professor Adrian contributed to the Neurology number of the Bulletin an article entitled "Physiological Mechanisms in the Brain" (*Brit. med. Bull.* 1945, 3, 1). Further details of his career may be found in the Notes on Contributors in that number.

DR E. A. CARMICHAEL is Director of the Medical Research Council's Neurological Research Unit at the National Hospital, Queen Square, London. During the Second World War he was Secretary of the Council's Military Personnel Research Committee, and a member of various other committees, among them, the Flying Personnel Research Committee. In 1942, Dr Carmichael, with Dr J. S. Weiner, Dr B. McArdle, and others, began a series of investigations into the effects of high temperatures on the comfort and efficiency of fighting personnel. Research activities on tropical clothing of the wartime Climatic Unit—of which Dr Carmichael was Director—have been described in Dr J. S. Weiner's article in the Personnel Research number of the Bulletin (*Brit. med. Bull.* 1947, 5, 20). Dr Carmichael's published work includes *On hereditary ataxia and spastic paraplegia*, written jointly with Dr Julia Bell, and published in 1939.

PROFESSOR W. E. LE GROS CLARK is Professor of Anatomy in the University of Oxford. His main interest for many years has been the study of the interconnexions of different parts of the central nervous system by experimental methods. In the past he has concentrated attention mainly on the sensory mechanisms of the brain—in particular the thalamus and the visual system. His earlier studies on the anatomy of the hypothalamus are now assuming a more obvious practical significance, for recent evidence indicates an important functional relationship between this primitive part of the cerebrum and the frontal areas of the cerebral cortex.

DR G. D. DAWSON was educated at Manchester University and carried out research there on recording nerve action potentials, gaining his M.Sc. in 1933. In 1936 he became medically qualified, and after holding various clinical appointments he began work on electroencephalography in 1938 at the Manchester Royal Infirmary. From 1941 to 1944 Dr Dawson was Assistant Director of the David Lewis Epileptic Colony and since then has been on the staff of the Medical Research Council, working in the Neurological Research Unit at the National Hospital, Queen Square, London. In collaboration with Dr W. Grey Walter, he has contributed papers on electroencephalography to the *Journal of Neurology, Neurosurgery and Psychiatry*.

DR JOHN C. ECCLES is Professor of Physiology in the University of Otago, Dunedin, New Zealand. He graduated in medicine in Melbourne in 1925 and came to Oxford, as a Rhodes Scholar, in order to be a pupil of Sir Charles Sherrington. He was a Fellow of Exeter College and later of Magdalen College, and a University lecturer in physiology until he left England in 1937. Professor Eccles, who was elected a Fellow of the Royal Society in 1941, has worked on many aspects of the transmission across the junctional regions between nerve cell and nerve cell (synapses) and between nerve cell and muscle (striated, cardiac and smooth). His recently developed electrical theories of synaptic excitatory and inhibitory processes have aroused much interest and are effectively stimulating research. He is part author of a book, *Reflex activity of the spinal cord* (1932), and the author of over ninety papers in the *Journal of Neurophysiology, Journal of Physiology, Proceedings of the Royal Society B, Nature*, etc.

DR WILHELM FELDBERG's main work has been on the physiology and pharmacology of histamine and acetylcholine. Until 1933 he was lecturer in physiology at Berlin University, which he was forced to leave in that year. He then worked at the National Institute for Medical Research, London, and later at the Walter Eliza Hall Institute, Melbourne, Australia; afterwards he became Reader in Physiology at Cambridge University. Dr Feldberg is now again at the

National Institute for Medical Research. In the years after 1933, he demonstrated, with Sir Henry Dale, Professor J. H. Gaddum and, later, with Professor G. L. Brown, the role of acetylcholine as a chemical transmitter across a synapse in the autonomic nervous system and from motor nerve endings to motor end-plates of striped muscle fibres. He was one of the first to demonstrate the release of histamine during the antigen-antibody reaction of anaphylaxis, and with Dr Charles Kellaway, in Australia, showed the release of histamine during poisoning by various snake venoms and by bee venom. With Dr N. Emmelin, Dr Feldberg has recently demonstrated that histamine occurs in high concentrations in the hair fluid of the nettle plant and, with acetylcholine, accounts for the reactions and sensations produced by the nettle sting in the human skin. He has written, with E. Schilf, *Histamin: seine Pharmakologie und Bedeutung für die Humoralphysiologie* (Berlin, 1930), and has translated into German books by Barcroft, Gaddum, and Krogh.

DR G. W. HARRIS obtained his M.D. degree at Cambridge in 1944, and is a lecturer in physiology at that University. He is a member of the Physiological Society, Anatomical Society and Endocrinological Society. He has contributed to various scientific journals papers on such subjects as the innervation and actions of the neurohypophysis and the induction by electrical stimulation of pseudo-pregnancy and ovulation in experimental animals.

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PROFESSOR GEOFFREY JEFFERSON was appointed Hunterian professor of the Royal College of Surgeons in 1942, and in June last year delivered the Lister Oration at the College. He now occupies the chair of neurosurgery at the University of Manchester. Professor Jefferson has gained world-wide recognition in the field of neurosurgery and has published many important papers on the subject. Fuller details of his career appeared in the Neurology number of the Bulletin, to which he contributed an article on head injuries (*Brit. med. Bull.* 1945, 3, 5).

DR HENRY McILWAIN previously worked in the Medical Research Council's Unit for Research in Cell Metabolism at Sheffield University, and afterwards carried out investigations of bacterial nutrition with the Council's Department of Bacterial Chemistry at the Middlesex Hospital, London. In 1948 he was appointed to the posts of Senior Biochemist to the Teaching and Research Laboratories, and Senior Lecturer in Charge of Biochemical Laboratories, at the Institute of Psychiatry, Maudsley Hospital, London. Various biochemical studies in connexion with the central nervous system are in progress in the laboratories of the Institute. Dr McIlwain contributed to a previous number of the Bulletin an article entitled "Analysis of Antibacterial Action" (*Brit. med. Bull.* 1946, 4, 259), with which a more detailed note on his early career was published.

MRS MARGARET MEYER is a research worker who, with the aid of a grant from the Medical Research Council, is engaged in a study of the connexions of the cerebral cortex by the use of silver techniques. For some time she worked in the Institute of Psychiatry at the Maudsley Hospital, London, investigating the anatomical changes in brains of patients who had undergone the operation of leucotomy. More recently, she has been amplifying the results of her observations on the human brain by making parallel studies in the Department of Anatomy at the University of Oxford on the brains of animals which have been subjected to localized lesions of the cerebral cortex.

## BRAIN METABOLISM AND ACTIVITY

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- 1 Changes in blood during its passage through the brain
  - 2 Changes in brain constituents
  - 3 Metabolic potentialities of brain tissues
  - 4 Balance between physiological and biochemical events in brain
  - 5 Utilization of energy-rich compounds
- References

In higher animals the main exchange of materials between the brain and the rest of the body is by the blood-stream; exchange by the cerebrospinal fluid is relatively sluggish. The blood supply to the brain is a large one, and if it is interrupted even for only short periods mental activities and the electrical activities of the brain are first disturbed and then cease. Analysis of the blood before and after its passage through the brain shows that changes have taken place in some of its constituents during the passage, and other experiments indicate that the magnitude and type of these changes vary with the activity of the brain. Accurate study of the major exchange occurring during such experiments is relatively recent, and has been chosen as the starting-point of this account, after which some concomitant changes in brain tissue and their relation to the activity of the brain are then considered. Many antecedent studies have of necessity not been described.

## 1. Changes in Blood during its Passage through the Brain

To determine the over-all metabolism of the whole brain *in situ*, representative samples of all blood entering and leaving the brain are analyzed; surgical techniques may be required in such experiments (Ferris *et al.* 1946; Gibbs, Maxwell & Gibbs, 1947). Simultaneously, the rate at which blood is flowing through the brain is determined; in normal adults this rate is about 600 ml./min. but under varying physiological conditions it can range between 300 and 1,300 ml./min. In a group of normal people the oxygen content of the blood fell from an average of about 20 volumes per cent to about 13 volumes per cent (Gibbs *et al.* 1942). This is a somewhat greater loss of oxygen than the average which is sustained by the blood in passing through the body. The loss of oxygen in the brain is accompanied by an almost exactly equivalent gain in carbon dioxide, that is, the brain's respiratory quotient is close to unity. This suggests that carbohydrate is the main substrate oxidized, and determination of arterial and venous levels of glucose confirms this. Thus one set of experiments showed that of the glucose which was lost on passing through

the brains of dogs, 87 per cent could be accounted for by the  $\text{CO}_2$  formed, 11.5 per cent by lactic acid, and some 2 per cent by pyruvic acid (Himwich & Himwich, 1946). It is thus unlikely that the brain ordinarily oxidizes any other substrate at a rate approaching that of its oxidation of glucose. Also, if the glucose level of the blood is lowered by insulin, the oxygen consumption of the brain falls, even though the blood contains other oxidizable substrates (Himwich & Fazekas, 1937; Wortis, Bowman & Goldfarb, 1940). The muscles of animals in which this was taking place maintained almost their normal respiratory rate by oxidizing fat or amino-acids; but the brain did not do so. It is presumably such metabolic characteristics which make the functioning of the brain particularly susceptible to hypoglycaemia.

The brain's oxygen consumption corresponds to a respiratory rate of about 2 ml.  $\text{O}_2$ /g. of brain/hr., or about 3 l.  $\text{O}_2$ /hr. in the whole brain of a normal adult. Its magnitude can be appreciated by comparing it with the oxygen consumption of the body as a whole, when it is found that in adults at rest the brain takes about one-quarter of the total oxygen used by the body. In infants, whose brain is much larger in proportion to the whole body, the corresponding value is about one-half (Folch, 1947). Brain metabolism is thus not only continuous, but at a relatively high level.

## 2. Changes in Brain Constituents

The very active exchange of materials which occurs between blood and brain makes it understandable that interruption of the blood-stream should disturb the functioning of the brain. The problem of how this functioning is maintained or disturbed has prompted investigations by other techniques. One technique has involved analysis of the brain itself, in order to discover what changes in its constituents are associated with changes in the materials supplied by the blood, or with changes in brain functioning induced by other means.

Post-mortem changes in brain constituents can be extremely rapid, and the most satisfactory techniques for obtaining the specimens needed in such work are to drop small animals or their heads into liquid air, or to freeze the exposed brain *in situ*. The necessity for such techniques was first shown in 1935 (Kerr, 1935; Avery, Kerr & Ghantus, 1935), when they were devised in order to obtain satisfactory values for the lactic acid, glycogen and phosphocreatine content of brain. Thus values of some 12–30 mg./100 g. brain for the normal lactic acid content of the brains of dogs or cats rose to 65 mg./100 g. brain if cooling was delayed for 2 to 3 seconds, while values for phosphocreatine fell. Such connexion between changes in carbohydrate and labile phosphoric acid derivatives has been the subject of many investigations which have aimed at finding chemical correlates of changed physiological activity, as will be seen in the account which follows.

When dogs were caused to breathe air low in oxygen content, the concentration of inorganic phosphate in the brain rose, while that of phosphocreatine fell (Gurdjian, Stone & Webster, 1944). Cyanides caused the same changes in cats (Olsen & Klein, 1947). Increasing the electrical activity of the brain by means of a variety of convulsants led also to a fall in phosphocreatine, adenosine triphosphate, glucose and glycogen, and to an increase in inorganic phosphate (Klein & Olsen, 1947; Stone, Webster & Gurdjian, 1945). Electrical stimulation produced a 50 per cent fall in phosphocreatine within one second; hexose phosphates and then inorganic

phosphates were formed (Richter & Dawson, 1949). Re-synthesis of the phosphocreatine took place within 15 to 45 seconds.

These data can be summarized by saying that respiration maintains, and activity depletes, the labile energy-rich phosphoric esters of the brain. Other changes also are consistent with this general observation. Increased activity or decreased oxygen led to a much greater utilization of glucose and to the formation of more lactic acid than would otherwise have been the case. Decreased activity in anaesthesia or sleep reduced the lactic acid content of the brain (Stone, 1938; Richter & Dawson, 1948a). Increased activity led to increase in free ammonia in the brain (Richter & Dawson, 1948b). The assessing of these various changes is greatly assisted by observations on intermediary metabolisms which are next described.

### 3. Metabolic Potentialities of Brain Tissues

Independently of the evidence described above, studies with separated tissues and tissue preparations from brain have shown that a major part of their enzymic make-up is related to the metabolism of carbohydrate and labile phosphoric esters. Thus the conversion of glucose to lactic acid is brought about by extracts from brain, and probably proceeds through hexose diphosphate as this compound is converted to lactic acid even more rapidly than is glucose (Ochoa, 1941b). Adenosine triphosphate, cozymase and magnesium ions are required for the reaction to proceed at its optimal rate (Uttér, Wood & Reiner, 1945). If fluorides are present to prevent break-down of adenosine triphosphate, esterified phosphate accumulates. Glycolysis is more rapid in the presence of a phosphate acceptor such as creatine (Ochoa, 1941b). Many of the individual stages of phosphorylating glycolysis, observed in other tissues, have also been shown to take place in brain. Hexokinase, phosphorylase and phosphoglucomutase are present (Shapiro & Wertheimer, 1943); phosphoglyceric acid was found to be converted to phosphopyruvic acid, which phosphorylated adenylic acid (Ochoa, 1941a). Dismutations involving fumarate, malate and pyruvate were shown to be dependent on the presence of inorganic phosphate (Long, 1945).

Many enzymes of the oxidative reactions of general schemes of carbohydrate metabolism also occur in brain and result in the formation of energy-rich phosphoric esters. Thus inorganic phosphate, an acid of the tricarboxylic cycle, and an adenosine phosphate and cocarboxylase are required for oxidation of pyruvate by pigeon brain dispersions (Banga, Ochoa & Peters, 1939; Ochoa, 1941b); cozymase, magnesium and cytochrome are also needed (Larner, Jandorf & Summerson, 1949). Such oxidation can yield energy-rich phosphates, esterifying initially some 600  $\mu\text{mol.}$  of phosphate/g. fresh tissue/hr. with a molar ratio of phosphate esterified/oxygen utilized, of about 4 (Ochoa, 1941a). Quantitative data are available on the tissue content of malic dehydrogenase (Potter, 1946), succinic dehydrogenase (Howe & Flexner, 1947) and cytochrome oxidase (Schneider & Potter, 1943).

### 4. Balance between Physiological and Biochemical Events in Brain

It is immediately understandable that chemical events in the brain should limit physiological ones. But it is observed also that physiological events limit chemical ones: that the

normal rate of brain metabolism is below its potential rate; that in sleep it is still further lowered, but that with increased physiological activity it is increased.

The rate of glycolysis is an excellent example of this phenomenon. Rates have been observed for this reaction in carefully prepared homogenates and extracts of brain which give indications of the metabolic potentialities of the tissue in this respect. Rates of glycolysis of 300–450  $\mu\text{mol.}/\text{g.}$  of brain/hr. are found (Ochoa, 1941b; Utter *et al.* 1945; Elliott & Henry, 1946; Meyerhof & Geliazkova, 1947). In normal brain the values quoted in a preceding section correspond to the much lower value of 36  $\mu\text{mol.}/\text{g.}/\text{hr.}$ , but this is very greatly increased in convulsions (Klein & Olsen, 1947).

There is not such a large difference between the potential rates of respiration and those ordinarily realized; homogenates have given rates of approximately 160  $\mu\text{mol.}/\text{g.}/\text{hr.}$  (Reiner, 1947; glucose or hexosediphosphate as substrates), or 135–225  $\mu\text{mol.}/\text{g.}/\text{hr.}$  (Larner *et al.* 1949; pyruvate as substrate). The normal rate by arteriovenous differences corresponds to 90  $\mu\text{mol.}/\text{g.}/\text{hr.}$ , and again is increased in convulsions.

The restraint normally imposed on glycolysis operates in separated tissues. The aerobic rate of formation of lactic acid from glucose by slices is normally low—some 15  $\mu\text{mol.}/\text{g.}$  fresh brain/hr. It can, however, be greatly increased by anaerobiosis, or aerobically by certain reagents of which phenosafranine is an outstanding one. Low concentrations of this substance accelerate glycolysis to values of some 250  $\mu\text{mol.}/\text{g.}/\text{hr.}$  (Dickens, 1936). Phenosafranine has now been found to affect a particular metabolic process which the preceding account suggests to be intimately connected with the level of metabolism in brain: this is the formation of energy-rich phosphates from inorganic phosphates during oxidation of pyruvate (Case & McIlwain, unpublished; for analogous observations in kidney preparations, see Judah & Williams-Ashman, 1949). The action of phenosafranine appears to be through its effect on cozymase metabolism (McIlwain, 1949); cozymase is needed for the oxidation. In the presence of phenosafranine, inorganic phosphate and phosphate acceptors remain uncombined, even though oxidation of carbohydrate is in progress. Now inorganic phosphate or phosphate acceptors are reactants in stages of carbohydrate degradation: at hexokinase, which constitutes the point of entry of glucose to glycolysis or oxidation, and again in reacting with glyceraldehyde phosphate. For these reactions, which cannot proceed without inorganic phosphate, phenosafranine provides, or prevents the removal of, phosphate and phosphate acceptors, which would otherwise have been combined. It is therefore understandable that the degradation of carbohydrate should be accelerated.

There is a close analogy in chemical events between the action of phenosafranine and of the convulsive agents discussed above. In those cases the increased physiological activity led to break-down of phosphocreatine and formation of inorganic phosphate and phosphate acceptors. Here also it is evident that these products can themselves stimulate the reactions which lead to their re-formation. A mechanism for controlling carbohydrate break-down by physiological need is thus provided through the balance between energy-rich phosphates and their break-down products.

A further aspect of the stimulated metabolism may be noted. This concerns the balance between the end-products of glucose metabolism, lactic acid and carbon dioxide. It



appears almost certain that in brain, as in general schemes for carbohydrate degradation, these two end-products are the result of two series of reactions which proceed in common from glucose to pyruvic acid. The pyruvic acid may then be oxidized if oxygen is available, or if not, it may form lactic acid. The number of energy-rich phosphate groups which can be generated during catabolism of glucose by these two routes differs widely, varying from 3 to 40 mol./mol. glucose. Thus the situation, observed physiologically, in which most of the glucose catabolized is oxidized completely, could be described as providing the most efficient means of deriving phosphate esters from glucose. In the absence of oxygen this cannot take place, and glycolysis is observed to increase. Aerobically, glycolysis is inhibited in some way; but it can, as was noted above, be released by agents such as phenosafranines. The aerobic inhibition may be mediated also through the availability of phosphate and phosphate acceptors; this and other possibilities have been much debated (cf. Burk, 1939; Lipmann, 1942). Both oxidation and glycolysis require phosphate, but the differential effect—the inhibition of glycolysis aerobically—may be explained in terms of the varying phosphate concentrations required (see Long, 1945) for the different reactions in which it participates.

### 5. Utilization of Energy-Rich Compounds

Knowledge is very limited of how, in any organ or tissue, the energy derived from metabolic processes is utilized in physiological functioning. In nervous tissues the following findings may be recorded, but at present they can be said to be no more than suggestive. The passage of a nerve impulse is associated with migration of ions. The magnitude of the electric disturbance is related to the magnitude of the ionic change in a way which would be expected were the ion difference responsible for the potential of the discharge (cf. Hodgkin & Katz, 1949). Differential ion gradients can be built up and maintained in separated nervous tissue (Rothenberg & Feld, 1948) and here they are found to require energy-yielding metabolic processes, including glucose break-down

(Krebs & Eggleston, 1949). Changes in specific organic constituents are also associated with propagation of nerve impulses. Among these is acetylcholine, and the re-synthesis of acetylcholine by systems from nervous tissue requires an energy-yielding reaction (Mann, Tennenbaum & Quastel, 1938, or the presence of adenosine triphosphate (Nachmansohn & Machado, 1943).

A major limitation in present knowledge of metabolic events in the brain is that the majority of biochemical investigations have been carried out with the organ as a whole of with preparations from relatively large portions of it. The physiologically important events in brain are extremely localized as well as being very rapid. They are undoubtedly dependent on maintenance of general metabolism which it has first been necessary to understand, and much remains yet to be discovered concerning the effects of various agents and conditions on the brain as a whole. But still less is known of the detailed connexions between metabolism and functioning in separated neurones; and relatively little is known of the biochemical peculiarities of different cell types and of different areas in the brain (see, however, Dixon & Meyer, 1936; Elliott, 1948). Feldberg & Vogt (1948) have shown the value of such studies in relation to the organization of the central nervous system. The results of orthodox histological studies also give hints of structural complexities for which the metabolic basis and significance have yet to be found.

It has been necessary, in preparing this account, to select a particular theme which is basic to neurophysiology, and which has recently attracted metabolic investigation. In doing so, many chemical, biochemical, endocrinological and pathological observations with metabolic findings or implications have been omitted. Ultimately the general subject of the utilization of chemically derived energy can be expected to bring an understanding of many observations in these categories. At present, it can be seen that very much more is known about the formation of the energy-rich compounds utilized in brain functioning, and about the control of their formation, than was known a decade ago.

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# THE RESPONSES OF MOTONEURONES

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- A Antidromic activation of motoneurones
  - 1 Antidromic propagation of impulses
  - 2 After-potential and excitability following antidromic activation
- B Monosynaptic orthodromic activation of motoneurones
  - 3 The electrical hypothesis of synaptic transmission
  - 4 Reflexly subliminal activation
  - 5 Reflex discharge of impulses
  - 6 After-potentials and excitability following orthodromic activation of motoneurones
  - 7 Action of repetitive orthodromic volleys on motoneurones
  - 8 Rhythmic discharge of motoneurones
- References

It may be claimed that virtually all precise investigations on the fundamental responses of the central nervous system have been performed on motoneurones either of spinal or of cranial nerves. Presumably this is attributable to the ease of selective excitation and recording. In particular these neurones can be subjected to monosynaptic excitation by impulses (orthodromic) from the large proprioceptor fibres of muscle and to activation by impulses propagated antidromically up the motor axons. The following account of recent investigations, largely carried out in this laboratory, is restricted to the responses of spinal motoneurones activated thus orthodromically or antidromically. However, this restricted account has some general interest, because, in the absence of precise investigations on other neurones, it has been customary to explain their reactions in terms of the known properties of motoneurones. Since the orthodromic volleys have been elicited from muscle nerves by stimuli not stronger than twice threshold, they have been virtually restricted to the largest proprioceptor fibres, and tests with graduated stimuli have established that all the synaptic excitatory actions described in Section B of this paper are attributable to these large fibres.

Since motoneurones are buried in the central nervous system, their electrical responses may conveniently be led off by a fine (50  $\mu$  diameter) needle electrode insulated except at its tip. Such a micro-electrode can be inserted close to a motoneurone or group of similar motoneurones (a motor nucleus), the other leading electrode being an indifferently placed large metal plate. Alternatively, the more prolonged electrical responses of motoneurones may be recorded from the ventral root, whither they have spread electrotonically. Both methods of recording inevitably introduce distortions. The interpretation of the "focal potentials" recorded with a micro-electrode in nerve tissue is now well understood (Barakan, Downman & Eccles, 1949; Brooks & Eccles, 1947; Lorente de N6, 1947a). A positive focal potential (micro-electrode positive to the indifferent) indicates that to a preponderating extent current is flowing outwards across those nerve cell membranes (of axon, soma or dendrites) in close proximity to the micro-electrode, i.e., that they are "sources" for extrinsic current flow. Conversely a negative focal potential indicates the preponderance of "sinks".<sup>1</sup> Since under the basal conditions for an experiment extrinsic currents may be flowing (e.g. due to injury), the positive or negative focal potentials recorded on activation do not signify absolute levels of "source" or "sink" respectively, but merely the change from the basal level.

There has been good agreement between the three methods that have been used to test the excitability of motoneurones: direct electrical stimulation through a buried micro-electrode; excitation by a monosynaptic orthodromic volley; and excitation by an antidromic volley fired up the motor axons. In the two former, the excitability is judged by the size of the spike discharged along the motor axons, in the latter by the size of the "soma spike" focally recorded close to the motor nucleus (see Section A1 below).

It is not possible in this brief summary to give a comprehensive treatment of the experimental investigations. Each section gives the explanations or hypotheses that have been developed and the simpler experimental tests that have been applied. In developing these hypotheses it has been assumed that the surface membrane of the nerve cell body (soma) and of its dendrites has electrical and excitatory properties essentially similar to that of a nerve fibre (non-medullated), and that the special features are mainly geometrical. However, it has been necessary to postulate some quantitative modifications of properties, e.g., that the soma and dendrites have slower electrical responses than the motor axon, and also larger positive after-potentials. This treatment is sound methodologically, for it ensures that additional postulates are introduced only when all attempts at an explanation have

<sup>1</sup> The term "source" refers merely to the flow of electrical current outwardly from the cell membranes into the external conducting medium, i.e., the cell membrane in such an area is regarded as a "source" for current flow; conversely it is a "sink" when electrical current is flowing from the external medium inwardly across it.

## BRAIN METABOLISM

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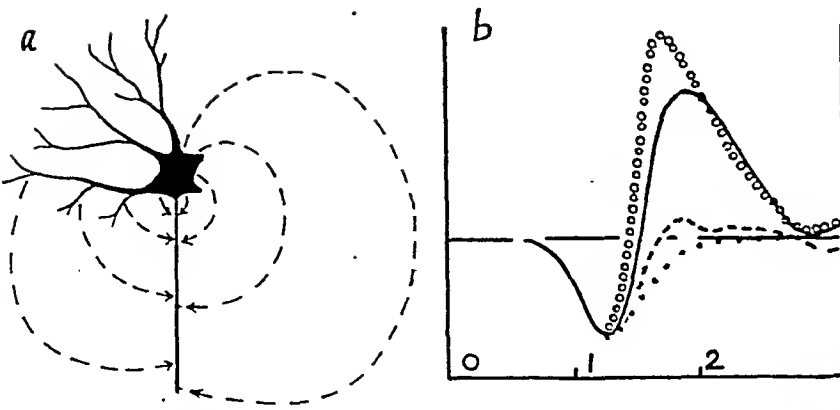


FIG. 1a. Diagram of external lines of current-flow generated by an antidromic impulse that has reached the axon hillock of a motoneurone. On the right the lines are drawn from the soma only, but on the left dendrites are drawn and lines are shown running from them

FIG. 1b. Continuous line shows a record of potential set up by a maximal antidromic volley in quadriceps nerve and recorded by micro-electrode just ventrolateral to quadriceps nucleus. Broken line and line of circles show, respectively, antidromic potential after conditioning depression by a preceding antidromic volley, and after conditioning facilitation by an orthodromic volley. For significance of dotted line see text. Time-scale in msec, with zero at time of stimulus

failed without them. The danger of development of unnecessary *ad hoc* hypotheses is thereby minimized.

## A. ANTIDROMIC ACTIVATION OF MOTONEURONES

### 1. Antidromic Propagation of Impulses

As an impulse propagates antidromically up a motor axon to its motoneurone, the positive focal potential recorded by an adjacent micro-electrode shows that the soma and dendrites of the neurone form a source for currents flowing back into the sink on the axon (fig. 1a), just as occurs from regions ahead of a propagating impulse in a nerve fibre (Barakan *et al.* 1949; Brooks & Eccles, 1947; Lorente de Nó, 1947a). A special feature, however, is introduced by the enormous expansion of surface membrane that begins at the axon hillock as the axon flares out to the soma and dendrites. This geometrical feature provides a satisfactory explanation for the blockage of antidromic axon-soma transmission that occurs with a large proportion of motoneurones (Barakan *et al.* 1949; Brooks & Eccles, 1947; Lloyd, 1943; Lorente de Nó, 1947a); for the area of the source of the soma and dendrites may be so large that the local circuits of current flowing to the axonal sink (fig. 1a) fail to depolarize the soma to that critical degree at which invasion of the impulse occurs. Even when the antidromic impulse does invade the soma and dendrites, the low safety factor in this invasion is evidenced by a brief delay (cf. fig. 2b) of about 0.1 to 0.3 msec. (Barakan *et al.* 1949), which presumably is attributable to slowed propagation into the expanding surface.

As would be predicted, antidromic axon-soma propagation is facilitated (figs. 1b, 2a) by the partial depolarization of soma and dendrites produced by subliminal orthodromic activation (Barakan *et al.* 1949; Brooks & Eccles, 1947; Lloyd, 1943; Renshaw, 1942), and is depressed (fig. 1b, broken line) during the increased polarization (positive after-potential, see

Section A2) following the propagation of one or more impulses over the soma and dendrites (Barakan *et al.* 1949; Brooks, Downman & Eccles, 1950a; Lloyd, 1943; Renshaw, 1942, 1946). The facilitation of antidromic transmission not only shortens the delay in axon-soma transmission (cf. the earlier origin of the negative spike, line of circles, in fig. 1b), but also relieves the blockage at many axon-soma junctions. Conversely the depression causes antidromic blockage at many junctions and increases the delay at those junctions still traversed. Thus the focal spike potential set up by an antidromic volley is divisible into a labile component generated by impulse propagation over the soma and dendrites and

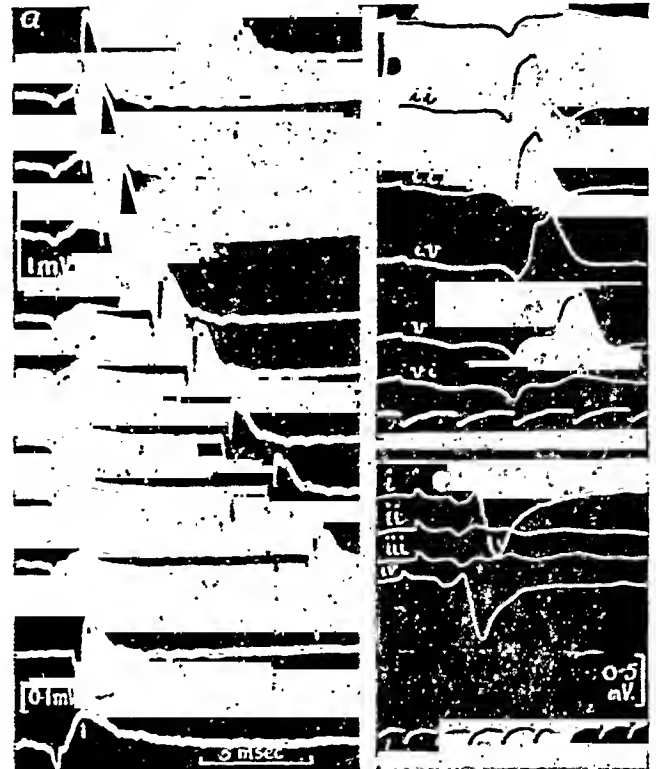


FIG. 2a. Records at top and second from bottom show focal potential set up in quadriceps nucleus by a maximum antidromic volley. Main series from below upwards shows progressively increasing facilitation of the negative (soma) spike as antidromic volley is moved earlier, relative to quadriceps afferent volley. Lowest record shows, at higher amplification, response to quadriceps afferent volley alone (subliminal reflexly)

FIG. 2b. Records i and ii show part of a series of antidromic focal potentials in which an antidromic volley set up by a slightly (1%) stronger stimulus always generated a larger potential, ii, which was not present with a weaker, i. It is concluded from this all-or-nothing behaviour that this additional potential is generated by the antidromic invasion of a single motoneurone. Record iii shows a small terminal change invariably produced by the conditioning depression of a preceding antidromic volley, while with records iv and v are seen two stages in lengthening of axon-soma delay before the final failure of antidromic transmission into the soma of that motoneurone, seen in record vi. Time in msec.

FIG. 2c. Antidromic focal potentials from single motoneurones as with records of fig. 2b, but showing the more usually observed positive potential (records i and iv). Antidromic stimuli for records ii and iii 1.1% weaker. Time in msec.

a non-labile component (approximately shown by dotted line of fig. 1b) due to the initial axonal component (Barakan *et al.* 1949).

The spread of the antidromic impulse over the soma and dendrites presumably is by "local circuit" action, but the fine dendritic terminals are apparently not invaded because the focal potentials recorded in the field around the motor nucleus indicate that the dendritic terminals continue to act as "sources" throughout the whole invasion process (Barakan *et al.* 1949). Possibly the profuse branching and diminishing calibre of the dendritic branches cause the invading impulse to slow and die out before reaching the terminals. It may be doubted (cf. Barakan *et al.* 1949) if much significance can be attached to the dendritic propagation velocity of 2 metres per second given by Lorente de N  (1947a).

It is usually possible to find a position of the micro-electrode such that it records the electrical response of one motoneurone, to the relative exclusion of all others. The records so obtained give the simplest illustration of the above propositions concerning antidromic propagation. Figure 2b shows the brief initial positive wave (soma and dendrites as source) followed by the negative wave due to invasion of the soma and dendrites. The spike so generated is about 1 msec. in duration, which is much longer than the axonal spike. During the depression set up by a conditioning antidromic volley antidromic axon-soma transmission is not blocked but is slightly delayed and the terminal phase of the soma spike potential is altered, possibly owing to an increased failure of propagation into dendritic terminals. In fig. 2b, after the records i to iii, a progressive axon-soma blockage developed (presumably due to mechanical damage by the micro-electrode), as is revealed by a lengthening of axon-soma delay. The longest delay (0.6 msec.) is shown in fig. 2b, v, and thereafter permanent blockage supervened. It is to be noted that, even after such a long delay, there is a normal soma spike potential (cf. v with ii), i.e., once the antidromic invasion has surmounted the critical region of low safety factor at the axon-soma junction, it proceeds at least as far as the dendritic terminals with a much higher safety factor, as would be expected on the local-circuit theory of propagation.

Usually (Barakan *et al.* 1949) single motoneurones have given a positive soma spike potential (fig. 2c), i.e., the inverse of that in fig. 2b. This is attributable to the micro-electrode lying close to an injured area of the neurone. Antidromic invasion of the remainder of the neurone diminishes the flow of injury currents into the region of the micro-electrode and hence will be recorded as a transient positivity, much as occurs with peripheral nerve in a like situation (Lorente de N , 1947b).

## 2. After-Potential and Excitability Following Antidromic Activation

Following antidromic activation, motoneurones show a large positive after-potential and an associated depression of excitability (Brooks *et al.* 1950a; Gasser, 1939); these are analogues of the positive after-potential and the subnormal state of peripheral nerve. The potential and the depression run virtually identical time-courses (fig. 3a; and Brooks *et al.*

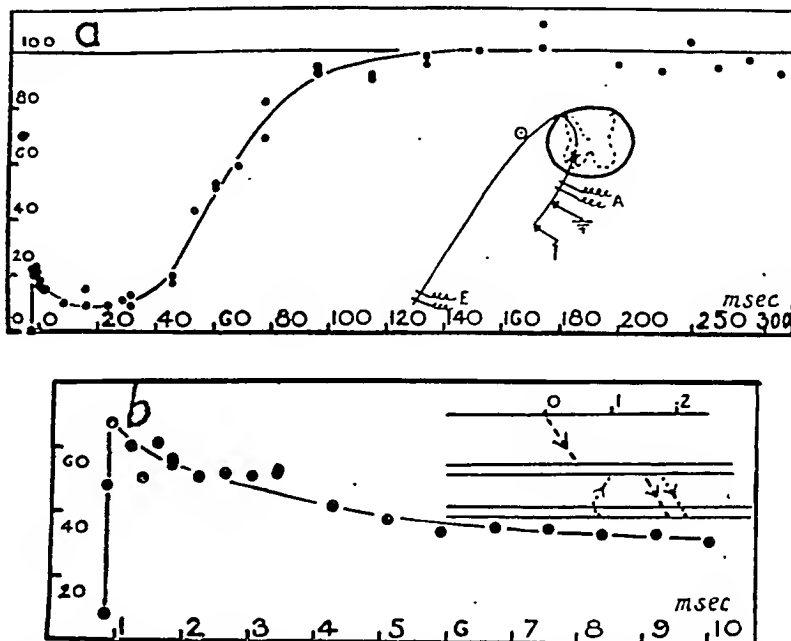


FIG. 3a. Inset diagram shows approximate position of electrodes, E being on the gastrocnemius-soleus nerve, while antidromic stimulating electrodes A are on isolated 1st sacral ventral root. Earth- and grid-leads to amplifier pick up the reflexly discharged spike responses more distally along that root. The testing stimulus through E is applied at various intervals after the conditioning stimulus through A, and its reflex spike response is plotted as a percentage of its mean reflex spike. Abscissae give stimulus intervals.

FIG. 3b. Plotting as in fig. 3a, but abscissae are the calculated intervals at the axon-soma junctions between arrival of the antidromic volley and emergence of the testing reflex discharge. Inset diagram gives basis of this calculation (see Brooks, Downman & Eccles, 1950a, for details).

1950a; Gasser, 1939), decaying from a maximum at about 20 msec. so as to disappear just beyond 100 msec. This time-course is somewhat slower than in peripheral nerve, but the greater size of the two effects provides a more striking difference.

It appears that two distinct processes are responsible for the decrementing after-negativity that immediately follows the soma spike potential and passes over into the after-positivity (Brooks *et al.* 1950a).

(i) In those neurones invaded antidromically there is evidence of a negative after-potential and associated phase of relative supernormality, i.e., of lessened subnormality, thus differing from peripheral nerve in that the excitability is always lower than normal, being supernormal merely to the subsequent depression.

(ii) Those neurones not invaded antidromically pass immediately into a phase of supernormal excitability, which decays rapidly and largely disappears in 10 msec. (fig. 3b). Any such neurone will have been depolarized to a subliminal extent by its antidromic impulse, i.e., it will be in a catelectrotonic state and hence will be supernormally excitable, the decay of this supernormality presumably indicating the time course of decay of the catelectrotonus. Thus the after-negativity would be compounded of a negative after-potential of the invaded motoneurones and a catelectrotonus of the uninvaded.

As shown in fig. 3b the uninvaded motoneurones show their maximum reflex excitability in less than 1 msec. after the arrival of the antidromic impulse at the site of its blockage

(Brooks *et al.* 1950a; Lloyd, 1943). A value as low as 0.7 msec. has been recorded. Thus the facilitated reflex discharge is propagated outwards almost as soon as the axon has recovered from its absolutely refractory period. On the other hand, when the motoneurones are invaded antidromically, they appear to be inexcitable by any test for at least 1.3 msec. and do not recover from their relative refractoriness until about 5 msec. The overlapping supernormal and subnormal states make these determinations inaccurate, but such complications are inherent in any method of determining neuronal refractory periods. Other methods of testing for refractoriness have to contend with additional complications.

## B. MONOSYNAPTIC ORTHODROMIC ACTIVATION OF MOTONEURONES

### 3. The Electrical Hypothesis of Synaptic Transmission

Almost all the experimental data in the sections that follow are satisfactorily explained by the electrical hypothesis of synaptic transmission (Eccles, 1946b, 1949); hence a brief preliminary account is desirable.

As a presynaptic impulse propagates up to a synaptic knob, this knob will be first a source (fig. 4a) and then a sink (fig. 4b) for currents flowing in extrinsic circuits to that presynaptic fibre upstream. It is postulated that a significant fraction of these currents loops through the post-synaptic membrane and hence will in the second phase (fig. 4b) exert a catelectrotonic action on the post-synaptic membrane immediately subjacent to the knob. It is further postulated

that this catelectrotonus (C.) is intense enough to set up an active response of that membrane—presumably by activation of the sodium carrier mechanism (Hodgkin & Katz, 1949). A synaptic knob is so small (about  $2\mu$  in diameter) that this post-synaptic activated area is far below the size at which a self-regenerative action would ensure its growth to a full-sized propagating impulse. Hence there will be merely a local response (L.R.) persisting for about the duration of a spike potential (about 1 msec., see Sections A1 and B5), during which time the synaptic knob will act as a sink (figs. 4c, 4d) through which other regions of the post-synaptic membrane discharge, and thus develop a 'catelectrotonus.' When the sink is no more, this catelectrotonic surround passively decays with the electric time constant of the post-synaptic membrane, being responsible meanwhile for the facilitation phenomena; hence it may be called the facilitation potential (F.P.). Alternatively, if many closely adjacent knobs are activated at the same time, then the flow of local current from the interposed areas of the membrane into the mosaic of sinks (post-synaptic L.R.'s) may be adequate to cause activation of these areas, i.e., these L.R.'s will spread and fuse, thus growing up to an impulse propagating over the surface of the motoneurone and down its axon. In this way a reflex discharge is generated.

### 4. Reflexly Subliminal Activation

A single orthodromic volley sets up in the motoneurones two closely related events—an increased excitability and a negative potential. The increased excitability is shown (by means of the three standard testing stimuli, direct, antidromic (fig. 2a), and monosynaptic orthodromic) to reach a maximum in little more than 1 msec. after the arrival of the orthodromic volley in the motor nucleus (Brooks & Eccles, 1947), and thereafter it decays with a half-time of about 3 msec. (Brooks & Eccles, 1947; Eccles, 1946a; Lloyd, 1946).

The negative potential, recorded after electrotonic spread along the motor axons to the emerging ventral root, has a rather slower time-course, rising to its summit in about 2 msec., and decaying with a half-time of about 5 msec. if care is taken to record from the root close to the spinal cord (fig. 5a) (Brooks, Downman & Eccles, 1950b; Brooks & Eccles, 1947; Eccles, 1946a). On the other hand, although having an identical latent period, the negative focal potential recorded with the micro-electrode placed just ventrolateral to the quadriceps nucleus has a faster time-course, attaining its summit in about 1 msec. and decaying with a half-time of about 1.5 msec. (fig. 5b). There is evidence that, on account of the asymmetry of quadriceps motoneurones, a micro-electrode in this position is favourably placed for recording currents flowing from the dendritic terminals and axon into the soma and proximal dendrites (Barakan *et al.* 1949), i.e., a negative potential there signifies a sink on the soma and dendrites. The discrepancy between the time-courses of the potentials recorded in these two ways can plausibly be attributed (cf. Brooks & Eccles, 1947) to distortion of the actual potential change of the motoneurone, which would run an intermediate time-course, and so be comparable with the facilitation curve (cf. fig. 10b in Brooks & Eccles, 1947). Thus, on this interpretation, the potentials recorded either focally or from the ventral root have a common origin in the depolarization process (L.R. plus F.P.) which is generated in motoneurones by synaptic stimulation and which decays with

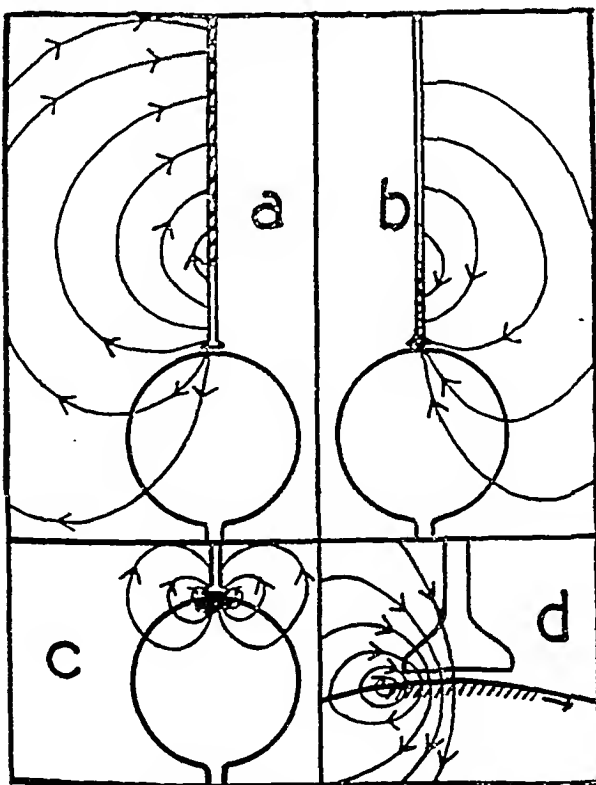


FIG. 4. Schematic representations of presynaptic fibre and motoneurone with lines of current-flow generated during synaptic transmission (see text)



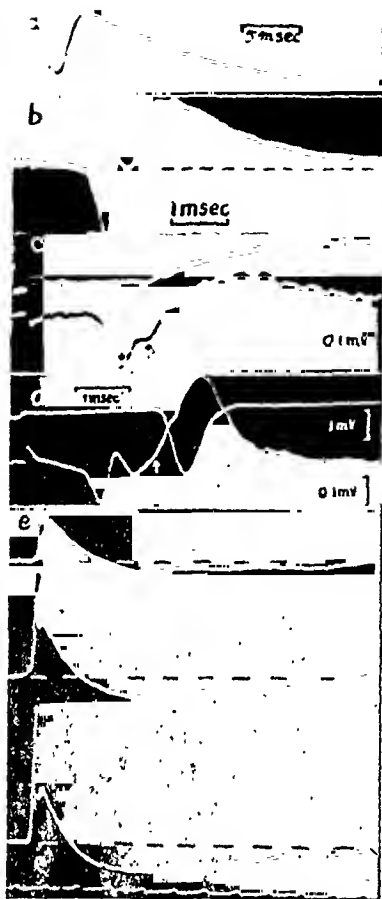


FIG. 5. Synaptic potentials set up by single orthodromic volleys and recorded as follows:

- a: after electrotonic spread to the emerging ventral root
- b: by a micro-electrode just ventrolateral to motor nucleus (quadriceps)
- c: recorded as in a and b for identical orthodromic volleys in same preparation. Note identical latent periods for the two synaptic potentials (lower one begins at second arrow, first arrow showing time of arrival of sink of orthodromic volley at presynaptic terminals)
- d: as in b, but with synaptic potential generating reflex discharge of a volley at arrow. Record of volley in ventral root is shown by inverted spike
- e: synaptic potentials recorded as in a, but for progressively larger orthodromic volleys in quadriceps nerve, the upper record being a pure synaptic potential and the two lower having reflex spikes superimposed. Note the later after-positivity

a half-time of about 3 msec. This rate of decay is much slower than is observed with catelectrotonus of the motor axons, but such observations are complicated by the myelin sheath and the nodes of Ranvier. As yet the rate of decay of a catelectrotonus set up directly by an electrical pulse has not been determined for motoneurons, but it is to be noted that the facilitation process (attributable to a catelectrotonus) generated by a blocked antidromic impulse (see Section A2) decays at a rate comparable with the above facilitation process. Recently it has been suggested (Lloyd & McIntyre, 1949) that the "focal synaptic potential" is generated presynaptically. However, it has been pointed out that there is much evidence against this interpretation (Eccles,

1949), and that the only supporting evidence may be otherwise interpreted (Brooks *et al.* 1950b).

As the presynaptic volley propagates up to the motor nucleus, it generates the initial diphasic wave (positive-negative) of the focal potential, and hence gives opportunity for precise determination of the synaptic delay. If this is measured between the arrival of the "sink" phase of the presynaptic volley at the motor nucleus and the onset of the "sink" phase in the motoneuron, i.e., of the negative potentials recorded either focally or from the ventral root, it has a duration of only 0.3 to 0.45 msec. (figs. 5c, 8b).

When the testing orthodromic volley is in a nerve synergic with one carrying a conditioning volley which alone evokes a large reflex response, it has been found that, with very short volley intervals, the facilitated spike may be discharged as a double wave (Brooks & Eccles, 1948). It appears that two distinct facilitation processes are involved, an initial  $\alpha$  process which decays so rapidly that it disappears at a volley interval of about 1 msec., and a  $\beta$  process characterized by a longer synaptic delay and the much slower rate of decay already described. An explanation of these two facilitation processes is provided by the electrical hypothesis of synaptic transmission, for the  $\alpha$  process has precisely the characteristics that would be given by the initial excitatory effects, C. and L.R., while the  $\beta$  process is attributable to the F.P. (Brooks & Eccles, 1948; Eccles, 1949). The  $\alpha$  process of facilitation has previously been known as the detonator action.

### 5. Reflex Discharge of Impulses

Focal recording (figs. 5d, 8b) shows how the reflexly discharged impulse arises as a sudden upward inflection in the negative (synaptic) potential (Brooks & Eccles, 1947), and a comparable observation may be made with the synaptic potential recorded from the ventral root (Brooks *et al.* 1950b; Eccles, 1946a). There is a delay of from 0.2 to 1 msec. between the onset of the synaptic potential and the initiation of the impulse. This value, when added to the synaptic delay determined for the synaptic potential (see Section B4), gives the delay in initiating the reflex discharge of an impulse, which would thus have a minimum value of about 0.6 msec., and a maximum of about 1.5 msec. Such a range of values would be expected if the reflex discharge arises by the spread and fusion of initially discrete L.R.'s having a duration of about 1 msec. If allowance be made for the asynchronism of the individual units, the focally recorded spike potential of discharging motoneurons has a duration of about 1 msec. (fig. 5d), which agrees well with the antidromic spike duration (figs. 1b, 2b). According to the local circuit theory of propagation, an impulse generated in the soma by synaptic excitatory action would readily propagate on to the axon and would not have the low safety factor characterizing transmission in the reverse direction (see Section A1).

### 6. After-Potentials and Excitability Following Orthodromic Activation of Motoneurons

When monosynaptic orthodromic activation has generated the discharge of impulses from motoneurons, it would be expected that a positive after-potential of the motoneurons would ensue, just as occurred after invasion by an antidromic volley. This is shown in fig. 5e, but a smaller positive after-potential running the same time-course is seen to follow a

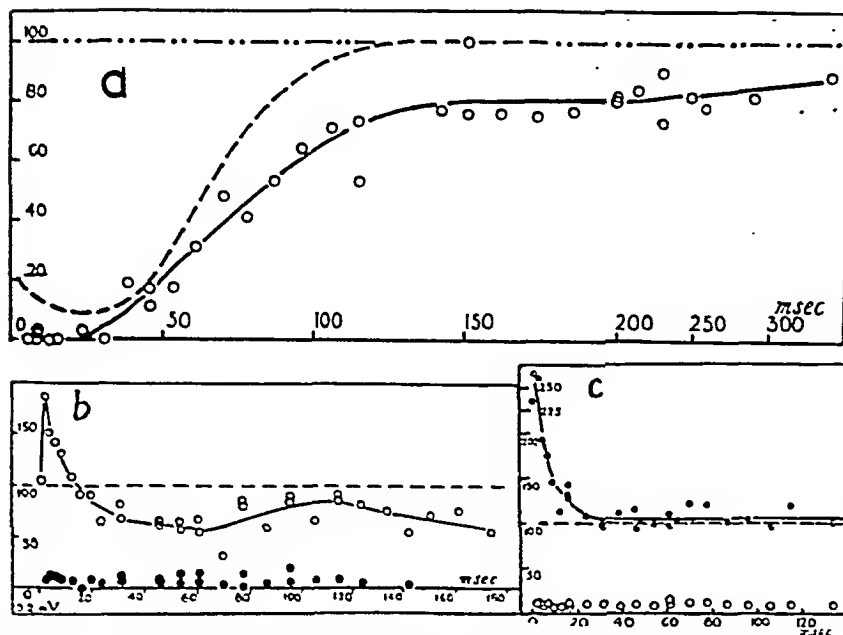


FIG. 6a. Plotting of testing reflex spike response as in fig. 3a, but the conditioning volley is a similar orthodromic volley. The broken line shows the curve of fig. 3a (same experiment)

FIG. 6b. As in fig. 6a—same experiment, but conditioning orthodromic volley so small that it evoked little or no reflex response. Filled circles show the sizes of these conditioning spikes also calculated as percentages of the mean control value for the testing reflex spikes and placed at abscissa values for corresponding testing responses

FIG. 6c. As in fig. 6b—same experiment, but with conditioning orthodromic volley in an afferent nerve (lateral gastrocnemius) synergic with that conveying the testing volley (medial gastrocnemius). Open circles give conditioning spike responses as in fig. 6b

synaptic potential on which no reflex discharge is superimposed. The superimposition of a reflex discharge merely adds to the positive after-potential.

The excitability of motoneurones during these positive after-potentials has been tested with monosynaptic orthodromic volleys (Brooks *et al.* 1950b; cf. Bernhard, 1947). When the testing volley was in the same afferent nerve as the conditioning, there was a very deep depression at 10 to 30 msec. (complete suppression of reflex discharge), and, initially, recovery occurred along much the same time-course as after antidromic activation of these motoneurones (fig. 6a). However, unlike the latter, this phase of recovery was always incomplete and was followed by a prolonged slow recovery of excitability persisting for at least one second. A similar, but usually less intense, depression with two-stage recovery was observed after a conditioning volley which was so small that it evoked little or no reflex discharge (fig. 6b). Presumably the initial phase of depression (i.e., up to about 100 msec.) is attributable to a subnormal state of the motoneurones associated with the positive after-potential, and is identical with that induced by antidromic invasion. When the conditioning volley sets up no reflex discharge, it will still, according to the electrical hypothesis (see Sections B3 and B4), set up local responses (L.R.'s) under the activated synaptic knobs and these areas would be expected to develop positive after-potentials and the associated depression. In accordance with this explanation little or no reflex depression was observed when the "reflexly subliminal" conditioning volley

was in a different, but synergic, nerve from the testing volley (fig. 6c). The small depression then sometimes observed (Brooks *et al.* 1950b) presumably is attributable to a spreading anelectrotonus from the localized areas of positive after-potential. On the available evidence the prolonged phase of depression is located presynaptically, for it is never observed when testing by a synergic orthodromic volley.

#### 7. Action of Repetitive Orthodromic Volleys on Motoneurones

The response to repetitive synaptic bombardment is of great interest because it would normally be produced by receptor organ discharges, and, if intense enough, it gives rise to rhythmic discharges of motoneurones. Repetitive orthodromic volleys are relatively ineffective in building up synaptic potentials by summation whether recorded focally or from the ventral root.<sup>2</sup> Even at frequencies as high as 500 per second, summation gives a transient maximum which at most is little more than

<sup>2</sup> Eccles & Rall, unpublished observations

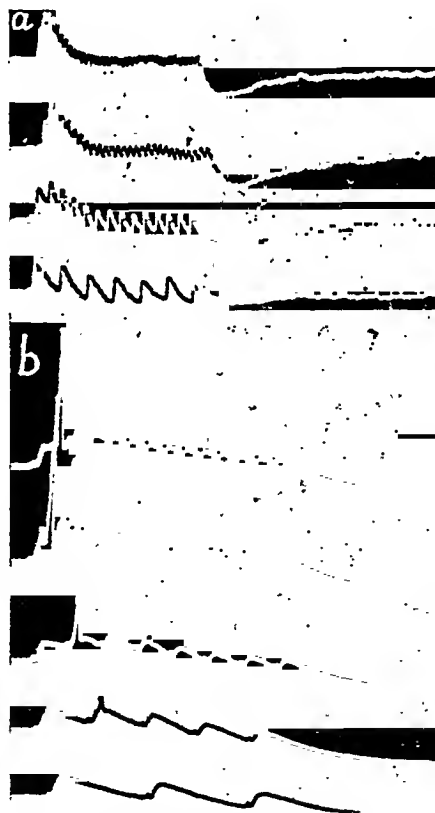


FIG. 7a. Synaptic potentials recorded from the 1st sacral ventral root and set up by repetitive orthodromic volleys in gastrocnemius nerve; the frequencies from above downwards are 200, 150, 75 and 35 per second

FIG. 7b. As in fig. 7a, but at a lower depth of anaesthesia, so that a single orthodromic volley sets up a small reflex spike discharge and a larger spike is evoked by the second volley at high frequencies of stimulation; the frequencies from above downwards are 350, 500, 150, 100 and 50 per second

double the single potential, and which, during continuance of the stimulation, rapidly declines to a plateau at about the level of the initial base-line (fig. 7a). On cessation of stimulation a large positive after-potential supervenes, which presumably explains the ineffectiveness of the summation. Analysis further reveals that this ineffectiveness is dependent on three factors: (i) the cumulative positive after-potentials of the preceding responses provide a positively deflected base-line on which the summed synaptic potentials are superimposed; (ii) at high frequencies the sizes of the successive synaptic potentials are greatly diminished relatively to the initial response (fig. 7a)—presumably owing to the depressant action exerted by the positive after-potential (located *ex hypothesi* in the subsynaptic membrane) on the generation of the L.R.'s by the successive C. responses of the subsynaptic membrane; (iii) at high frequencies the relatively and absolutely refractory periods both of the presynaptic fibres and of the motoneurones would also exert a depressant action.

The reflex discharges evoked during repetitive stimulation conform with the synaptic potential picture, for discharges may be evoked by the first, second and even the third volleys at high frequencies (200 up to 500 per second), but not as a rule thereafter, as would be expected from the falling level of synaptic potential at this stage (fig. 7b). A frequency as high as 75 per second is required before any summation occurs, and then it is restricted to the second volley. Since even 75 per second would be an unusually high frequency for discharges from the proprioceptors of muscle, it may be concluded that temporal summation under synaptic knobs is by itself virtually ineffective in evoking reflex discharges. As an apparent exception to the above statements, the motoneurones of some muscles give reflex discharges throughout repetitive stimulation of the large proprioceptor fibres, but there is evidence that this is attributable to additional activation through interneuronal pathways.<sup>3</sup>

On cessation of the repetitive train of orthodromic volleys, testing by a single similar orthodromic volley reveals a deep depression for 10 to 20 msec., resembling that following a single volley (see Section B4), and then a rapid recovery to a phase of supernormal reflex excitability (fig. 8a), which slowly decays over several minutes. Our experiments confirm the recent systematic study by Lloyd (1949) in showing that this supernormality is dependent on some change whereby a pre-synaptic impulse becomes a more effective excitor of motoneurones which themselves have unchanged excitability. Furthermore this change is restricted to those presynaptic fibres which were repetitively stimulated. Focal recording may reveal no change in the size of the presynaptic volley in the motor nucleus, the first sign of the supernormality being seen in the steeper rise of the synaptic potential right from its origin (fig. 8b). Lloyd (1949) suggests in explanation that the repetitive stimulation sets up a positive after-potential (P2 component) of the presynaptic fibres, which, by increasing the size of the presynaptic impulses, causes them to be more effective synaptic exciters. If such an increase were as much as 2 per cent it would be detectable in records of the presynaptic spike in the motor nucleus (fig. 8b), and yet at the same time there is an increase in the focal synaptic potential of as much as 100 per cent and a reflex spike discharge often several times the normal control. Furthermore a large facilitation

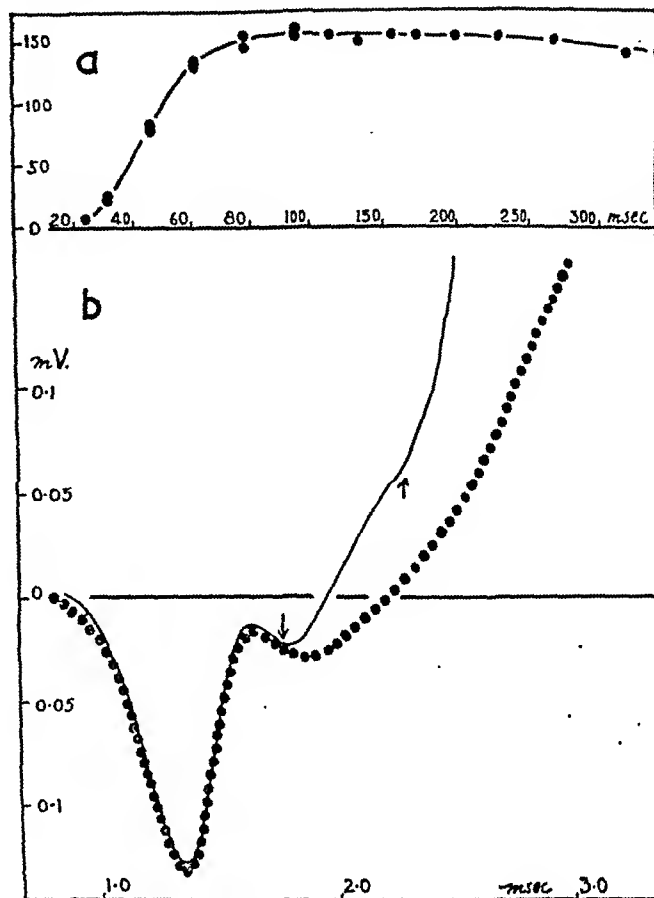


FIG. 8a. Curve drawn as in fig. 6a, but with conditioning by repetitive orthodromic volleys (300 per second for 0.17 sec.). Zero time is at last volley of conditioning series.

FIG. 8b. Dotted line is the mean of six closely similar records of focal potentials set up by an orthodromic volley in quadriceps nerve and recorded just ventrolateral to the quadriceps nucleus (see fig. 5b). Continuous line shows the focal potential (mean of two closely similar records) recorded at 220 msec. after conditioning by repetitive orthodromic volleys (300 per second for 0.3 sec.). First arrow marks the first detectable sign of the increased response, which would coincide with start of the "focal synaptic potential" (cf. fig. 5c). Second arrow marks the inflection that signals the initial of the reflex spike discharge in the facilitated record (confirmed by timing of spike in ventral root, cf. fig. 5d). Note that slight difference between two records prior to first arrow is attributable to a slight shift in base-line. Stimulus to quadriceps nerve at zero of time-scale.

effect, prolonged for minutes, is obtained after as few as 20 volleys, which makes the positive after-potential explanation unlikely. With the severe conditioning tetani of some thousands of volleys employed by Lloyd (1949) we have observed at long test intervals (seconds) the approximate parallelism that he reported between increased presynaptic spike and potentiated synaptic excitatory action (reflex discharge or synaptic potential). But it would appear that this correlation is merely fortuitous, because with shorter test intervals and with shorter conditioning tetani the presynaptic spike of the testing volley is diminished in size and yet there is a large potentiation of its synaptic excitatory action. It would appear that Lloyd's explanation of potentiation is inadequate.

<sup>3</sup> Eccles & Rall, unpublished observations

Since it has been shown that an acetylcholine mechanism is not significantly concerned in synaptic transmission in the spinal cord (Eccles, 1947), the most probable alternative postulate is that the presynaptic impulse becomes a more effective synaptic excitator because repetitive stimulation temporarily alters the spatial relationship of the synaptic knobs to the post-synaptic membrane, e.g., the knobs may become larger and/or in closer apposition thereto. It is to be noted that this facilitation process is approximately 30,000 times longer in duration than the process due to the facilitation potential (F.P.) and thus is more likely to provide a basis for an explanation of those prolonged functional changes in the nervous system that occur in conditioned reflexes, and which presumably depend on some change in the form or structure of the synapse (Konorski, 1948).

### 8. Rhythmic Discharge of Motoneurones

The foregoing concepts of the excitatory properties of motoneurones may be used in outlining a hypothesis to account for the rhythmic discharges, usually at 10 to 50 per second, of motoneurones that are subjected to a continuous synaptic bombardment of sufficient intensity. The temporal summation of the excitatory effects produced by repetitive bombardment of synaptic knobs has usually been assumed to explain the build-up of an excitatory state, but it has been shown that this is ineffective at the repetitive frequencies that normally obtain (see Section B7). However, spatial summation between the excitatory effects set up under different synaptic knobs on a motoneurone is effective for the duration of the individual facilitation potential (about 15 msec.). The normal randomly distributed bombardment of the various knobs on the surface of a motoneurone is therefore likely to

give rise to combinations of excitatory foci sufficiently close together in time and space to generate a propagated impulse in the way described above (see Sections B3 and B5). Following such an impulse there will be a positive after-potential and associated subnormal state (see Sections A2 and B6) from which complete recovery will take 100 msec. or more. As this recovery becomes progressively further advanced, i.e., from 20 msec. to beyond 100 msec., there is an increasing probability that the continuous random synaptic bombardment will give once more some combination of excitatory foci that will be adequate to initiate the discharge of an impulse; and so on for each successive discharge. Thus the frequency of the rhythm would be higher the more intense the bombardment; and there is in addition a random factor depending on the chance activation of contiguous knobs in close temporal sequences. The recovery from the positive after-potential would account for the fairly regular frequencies observed at any adequate intensity of bombardment; but, if the bombardment falls to such a low intensity that it rarely gives a threshold combination of excitatory foci even for the fully recovered motoneurone, the discharges will be conditioned only by the random factor and will lose all semblance of regularity. Thus the properties of motoneurones as described in the foregoing sections give a satisfactory explanation of the observed discharges of motoneurones under continuous synaptic stimulation.

### ACKNOWLEDGEMENTS

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# THE ROLE OF ACETYLCHOLINE IN THE CENTRAL NERVOUS SYSTEM

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- 1 Continuous activity in the central nervous system and in sympathetic ganglia
  - 2 Acetylcholine as transmitter in sympathetic ganglia
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It is easy to show that acetylcholine is a substance occurring naturally in the central nervous system. Properly prepared brain extracts when tested on a variety of organs show all the typical reactions of acetylcholine, and acetylcholine has, in fact, been chemically identified in brain extracts (Stedman & Stedman, 1937). The following questions then arise: is acetylcholine a central synaptic transmitter? if so, is it the universal central transmitter, or does it exert this function at certain synapses only? or is it perhaps merely a by-product of some metabolic process in brain?

The possible function of acetylcholine as a central synaptic transmitter was first envisaged by Dale (1935) and was the natural outcome of experiments which suggested that acetylcholine was responsible for neuromuscular transmission in skeletal muscle and for synaptic transmission in sympathetic ganglia.

## 1. Continuous Activity in the Central Nervous System and in Sympathetic Ganglia

We may, however, question the extent to which we are justified in comparing a central synapse with that in a sympathetic ganglion, where a preganglionic impulse gives rise to a single impulse in the postganglionic fibre and a 1 to 1 correspondence exists. This is in sharp contrast to the continuous activity in the central nervous system. For its explanation, the well-known theories of delayed pathways through interneurons and of re-exciting circuits in closed chains of neurones have been postulated. According to these theories continuous activity is dependent on internuncial neurones and should therefore be absent in sympathetic ganglia. But when impulses are sent into a sympathetic ganglion at a sufficiently high frequency, it continues to discharge after stimulation has come to an end (Larrabee & Bronk, 1938;

Bronk, 1939; Eccles, 1944). It is true that the required frequencies are higher than any observed *in vivo* coming from sympathetic centres, but the results show that there is no fundamental difference between the two transmission processes. Continuous nervous activity may, in fact, depend not mainly upon the anatomical arrangement of pathways but upon some kind of ionic instability. Even nerve and muscle fibres may discharge spontaneously and "oscillate" when deprived of their calcium.

The transmission process in a sympathetic ganglion can thus still be regarded as a likely representation of what is happening at the central synapse.

## 2. Acetylcholine as Transmitter in Sympathetic Ganglia

Most of the evidence of the role of acetylcholine in the transmission process has been obtained on the superior cervical ganglion of the cat. This organ weighs about 20 mg. and contains, closely packed, about 100,000 cells. It can be perfused from its artery. All preganglionic fibres impinging on the cells run in the cervical sympathetic nerve, which can easily be stimulated. The theory that acetylcholine transmits the impulses from the preganglionic endings to the ganglion cells is based, in the main, on the following findings (Dale, 1914; Feldberg & Gaddum, 1934; Feldberg & Vartiainen, 1935; Brown & Feldberg, 1936a, 1936b; von Brücke, 1937; MacIntosh, 1938a, 1938b; Bronk *et al.* 1938; Bronk, 1939; Kahlson & MacIntosh, 1939; Feldberg, 1943; Sawyer & Hollingshead, 1945):

(i) Acetylcholine stimulates the ganglion cells to discharge impulses into the postganglionic fibres. The frequency of the discharge depends on the concentration of acetylcholine in the perfusion fluid. With a high concentration, stimulation is followed by paralysis. In this condition the ganglion cells no longer discharge on renewed application of acetylcholine or on stimulation of the cervical sympathetic nerve.

(ii) Acetylcholine appears in the venous effluent from a ganglion during preganglionic nerve stimulation, provided eserine is present in the perfusion fluid. The former difficulty of detecting the acetylcholine released from a ganglion perfused with whole blood has recently been cleared up by Emmelin & MacIntosh (*in press*). They have shown that the same amounts of acetylcholine are released per nerve impulse, whether the ganglion is perfused with eserinated saline solution or undiluted eserinated plasma. In order to obtain this result with whole blood, however, eserine had to be given in much higher concentrations, otherwise the true cholinesterase of the red cells, which is the enzyme in blood responsible for the destruction of the released acetylcholine, remains active. This had not been realized in the earlier experiments because, at that time, Mendel and Rudney's distinction between true and pseudo-cholinesterase was not known (Mendel & Rudney, 1942).

(iii) Acetylcholine is released on preganglionic nerve stimulation, even when the ganglion cells have been paralysed by curare or nicotine, but not on antidromic stimulation of the postganglionic trunk, which backfires impulses into the ganglion cells. Degeneration of the preganglionic nerve fibres entails the disappearance of acetylcholine, of choline acetylase and of true cholinesterase in a sympathetic ganglion, but its cells remain sensitive to acetylcholine. Thus, the acetylcholine metabolism in a sympathetic ganglion is located entirely in the preganglionic nerve endings. Here the



acetylcholine is stored, formed and released, and here, too, the enzyme for its destruction, the true cholinesterase, is located. The ganglion cells themselves are not involved in acetylcholine metabolism, but are merely the effector structures on which the released acetylcholine acts.

The methods used for the sympathetic ganglion are only to a limited extent applicable to the central nervous system. Synapses are not confined to one place, perfusion methods are difficult and, in addition, the transmission at the various synapses may involve different transmitter substances. Nevertheless, attempts have been made to apply the methods used on sympathetic ganglia, or modifications of these methods, to the central nervous system. We shall confine ourselves to a discussion of the results obtained by the following lines of research: the central actions of acetylcholine; the central actions of anticholinesterases; the release of acetylcholine; changes in the acetylcholine content; and synthesis of acetylcholine.

### 3. Electrophysiological Considerations

The problem of central synaptic transmission by acetylcholine has also been taken up by electrophysiologists, and many have stated that acetylcholine cannot be the central synaptic transmitter. They have certain ideas of how the acetylcholine released at the synapse should influence their electrical recordings, but these expected changes have not been observed. The following example, however, may illustrate the difficulty of deciding the acetylcholine theory of central synaptic transmission on electrophysiological data alone. Measurements have been made of the synaptic delay in the central nervous system and at some synapses the delay was found to be about 0.5 msec. (Lorente de Nó, 1939), an extremely short time interval indeed, so short that it appeared to exclude the possibility of release and action of acetylcholine. What it actually excluded was the possibility that a process of diffusion of a substance from the site of liberation to a distant site of action could be involved in the transmission process.

Far too much emphasis has been laid on the brevity of the time intervals as an argument in favour of or against the acetylcholine theory. These measurements give us a time limit in which the process has to occur, but they do not provide evidence of its nature. The corresponding time values for neuromuscular transmission or for synaptic transmission in a sympathetic ganglion are of the order of 2 to 3 msec. If we can imagine a process happening within 2 msec., there are no insurmountable difficulties in envisaging it happening in a quarter of that time. We should remember that the role of acetylcholine in the transmission from motor ending to motor end-plate, or from sympathetic ending to the cell of a sympathetic ganglion, was not determined electrophysiologically, and it is doubtful whether the issue of a transmission process can be decided by this approach. If other methods prove that acetylcholine has a function as a central synaptic transmitter, the electrophysiological facts must be interpreted accordingly; if proof for a different mechanism should be found, they would have to be explained in terms of this other mechanism. To use an analogy: the thermometer measures the temperature of a patient, but the finest analysis of a temperature curve is insufficient to decide which bacterium or virus is responsible for the infectious disease, though it may provide suggestive evidence.

### 4. Central Effects of Acetylcholine

Acetylcholine applied locally, or injected through the vertebral or carotid artery, or intrathecally, has both stimulating and depressant central effects. These are enumerated in Table I, which is not meant to give a complete list of all central effects so far found, but to illustrate the fact that the action of acetylcholine on many sections of the neuro-axis, from the cerebral cortex to the spinal cord, has been described.

In some instances, particularly when acetylcholine is applied locally, it is advisable to give eserine beforehand. For example, the local application of acetylcholine to the cortex of the cat's brain appears to produce its full characteristic effect only when this is done. Then, however, it induces large 10 per second spikes in the electrocortigram, together with motor activity on the contralateral side. The "acetylcholine spikes" suggest synchronous firing of several cortical neurones under the influence of cells with short axons, each of which controls a number of pyramidal cells (British Association, 1948). The electrical discharges of the cortex produced by acetylcholine are similar to seizure discharges, and several authors take the view that a disturbance in the acetylcholine metabolism may be an important factor in the causation or mechanism of the convulsive seizures in epilepsy (Brenner & Merritt, 1942; Forster, 1945; Richter & Crossland, 1949).

The question has often been asked whether the central actions of acetylcholine should be classed as muscarine or as nicotine actions. This classification of the peripheral actions of acetylcholine was suggested by Dale in 1914. It is not possible to extend the nomenclature to the central actions without encountering certain difficulties. If atropine sensitivity were taken as the decisive factor in classification, many of the central actions of acetylcholine would have to be grouped with the muscarine actions. But the subdivision emphasizes also the structures on which the acetylcholine acts. Its effect on gland cells, smooth muscle, heart and the capillary endothelium falls within the domain of muscarine action, whereas the nicotine action is exhibited on the cells of the suprarenal medulla, the motor end-plates of skeletal muscle and on the nerve cells of sympathetic and parasympathetic ganglia. The structures involved in muscarine action have nothing in common with the cells of the central nervous system, but the properties of the motor end-plates and of the cells of the autonomic ganglia resemble those of the cells of the central nervous system. Therefore it is probably better to associate the central actions of acetylcholine with its nicotine actions but to confine the rigorous classification of muscarine and nicotine action strictly to its peripheral effects.

### 5. Central Effects of Eserine and other Anticholinesterases

It may be argued that we are not justified in regarding the effects of acetylcholine as anything more than interesting pharmacological phenomena; after all, there are many substances affecting central nervous activity, often in an even more striking manner. Against this argument, we can state that acetylcholine is a substance occurring naturally in the central nervous system and that we can obtain similar effects when, instead of applying acetylcholine artificially, we create conditions in which acetylcholine released at the synapse is prevented from being destroyed and thus allowed to

TABLE I. SUMMARY OF THE CENTRAL EFFECTS OF ACETYLCHOLINE

Site	Method of application	Effects	References
Cerebral cortex (man, cat, rabbit)	Local application ; arterial and intracisternal injection	On local application : motor effects on contralateral side. On intracisternal injection : general convulsions. Typical changes in cortical electrogram. Increased amplitude and frequency of Berger waves on arterial injections of 0.1–0.2 $\mu$ g. Increased electrical activity and after-discharge to stimuli in acoustic region (awakening reaction) and in area for mastication. Stimulation of suppressor areas	Sjöstrand, 1937; Bonnet & Bremer, 1937a, 1937b; Bremer, 1938; Moruzzi, 1939; Miller, Stavraky & Woonton, 1940; Gerard, 1941; Chatfield & Dempsey, 1942; Brenner & Merritt, 1942; Forster & McCarter, 1945; Forster, 1945; British Association, 1948; Beckett & Gellhorn, 1948; Hyde, Beckett & Gellhorn, 1949
Hypothalamus	Intraventricular injections	Sleep and drowsiness obtained regularly in cats, irregularly in man Apnoea ; inhibition of motor activity of intestine	Dikshit, 1935; Silver & Morton, 1936; Henderson & Wilson, 1936 Emmelin & Jacobsohn, 1945
Supra-optic nucleus (dog)	Local application	Release of posterior pituitary hormone	Pickford, 1939, 1947
Respiratory centre	Local application. Injections with chemo-receptors excluded	Stimulation preceded or followed by depression	Dikshit, 1934; Heymans <i>et al.</i> 1935; Shuh, Wang & Lim, 1936; Schweitzer & Wright, 1938a, 1938b; Gesell, Hansen & Worzniak, 1942; Gesell & Hansen, 1943; Miller, 1943
Trigonum hypoglossi	Local application	Tongue contractions. Deglutition	Miller, 1943; British Association, 1948
Cardiac centres	Arterial injection	Irregularities of heart action, as on central vagus stimulation	Dikshit, 1934; Heymans <i>et al.</i> 1935; Silver & Morton, 1936; Henderson & Wilson, 1936
Pressor centre	Iontophoresis	Rise in arterial blood-pressure	Shuh, Wang & Lim, 1936
Spinal cord	Perfusion experiments. Arterial and intrathecal injections	Discharge of motor impulses  Reflex activity altered	Feldberg & Minz, 1932; Lefebvre & Minz, 1936; Bülbring & Burn, 1941; Calma & Wright, 1944  Schweitzer & Wright, 1937; Bonvallet & Minz, 1937, 1938a, 1938b; McKail, Obrador & Wilson, 1941; Martini & Torda, 1938; Torda, 1940; Bülbring & Burn, 1941; Kremer, 1941

accumulate. Such a condition is brought about by the action of anticholinesterases.

The cardinal problem of the action of these substances is the extent to which we are justified in attributing their effects to the accumulation of undestroyed acetylcholine. If this were indeed the whole explanation of the mechanism, then the effects of anticholinesterases would represent the strongest evidence for the acetylcholine theory of central synaptic transmission. The problem is not an easy one. The cholinesterase-inhibiting action of eserine, for instance, is explained on the assumption that it competes with acetylcholine for the same receptor of the enzyme. But if they compete for the same receptor, they may also do so at the respective functional receptors of the nerve cells. Thus the possibility exists of acetylcholine-like actions of anticholinesterases independent of the inhibition of true cholinesterase. In fact, such actions do occur in the case of prostigmine. For instance, Ricker & Westcoc (1948) have recently shown that

prostigmine produces muscular contractions when injected into the muscle artery of a cat whose cholinesterase has been completely inhibited by previous treatment with another anticholinesterase such as di-isopropylfluorophosphonate (DFP).

Concerning the *peripheral* actions of eserine, there are many observations which provide strong proof that they are fully accounted for by inhibition of the enzyme. The following three instances show that an acetylcholine-sensitive structure reacts to eserine only when acetylcholine is present and released.

i. The isolated intestine and uterus of the guinea-pig: both contract to acetylcholine, but the intestine alone to eserine. The intestinal wall produces and releases acetylcholine continuously; this is not true of the uterus.

ii. Acetylcholine and eserine both constrict the pupil. But after degeneration of the parasympathetic nerve supply, the pupil no longer contracts to eserine, whereas it still contracts to acetylcholine. The normal iris contains acetylcholine;

the denervated iris is free from it. Thus, eserine cannot act.

iii. Eserine injected into an anaesthetized cat causes fascicular twitchings and fibrillation of skeletal muscles even after severance of the motor nerves, but two to three days after nerve section eserine is inactive. Within this time the nerve fibre and its ending have lost their acetylcholine, their ability to form it and consequently to release it. Thus eserine has become inactive. This instance is of particular interest because the processes at the motor end-plate have always been regarded as furnishing a kind of analogy to those at the central synapse.

If the peripheral actions of eserine can be accounted for by accumulation of released acetylcholine, the same mode of action may apply at least to some of the central actions of eserine. This appears to be the only convincing explanation of the effects of small doses of eserine. Larger doses, however, may have additional "direct" effects as well. In particular, the paralyzing effects so easily obtained with larger doses of eserine and of other anticholinesterases may not always be due solely to accumulation of acetylcholine. Some ideas about this paralyzing action will be given later.

There is no need to enumerate the central actions of eserine and other anticholinesterases. They resemble those of acetylcholine with the following main differences: (i) the onset and the disappearance of the effect is usually more gradual than with acetylcholine and (ii) compared with acetylcholine, depression is even more pronounced and more easily obtained than stimulation.

From among the great number of observations which show that eserine causes discharge of motor impulses in the central nervous system, followed by depression, I would like to mention one observation on the isolated cat's head perfused with diluted blood (Chute, Feldberg & Smyth, 1940). This observation was not the first, nor even an important one, but it is particularly impressive. The fully isolated head was mounted on a stand and connected with the perfusion arrangement by rubber tubing. On the addition of eserine to the perfusion fluid, there occurred a spontaneous blinking reflex at a rate of about 80 per minute and jerky movements of the head. A striking picture indeed! The muscular contractions were of central origin and disappeared after motor nerve section. How can they be explained if not by accumulation of released acetylcholine; and, if this is so, then—at least for some of the synapses involved in the central pathways of these reflexes—acetylcholine must be the central transmitter.

Schweitzer, Stedman & Wright (1939) have tried to explain the variety of effects obtained with various anticholinesterases. Tertiary bases such as eserine are lipid-soluble and were thought to penetrate the cells and act as convulsants, whereas quaternary bases, such as prostigmine, are lipid-insoluble and were thought to remain outside the cells and act as depressants. This theory, attractive as it may appear, does not, however, explain all the known facts; there are sufficient observations, such as those by Merlis & Lawson (1939), McKail, Obrador & Wilson (1941), Bülbring & Burn (1941) and Calma (1949), which show that eserine and prostigmine influence reflex activity in the same way.

Recently, another anticholinesterase, DFP, has been widely examined. Its anticholinesterase activity was discovered during the war, independently by Adrian, Feldberg & Kilby (1947) and by Mackworth & Webb (1948). It differs from eserine in its much more prolonged action, which is due to the fact that it forms an irreversible combination with the enzyme.

Another recently discovered inhibitor of cholinesterases (DuBois & Mangun, 1947), probably acting like DFP, is tetraethylpyrophosphate (TEP). But both substances also inhibit respiration of brain tissue and, in this respect, differ from eserine. Some of their depressant actions may therefore result not from inhibition of cholinesterase but from interference with the cell metabolism (Brooks, Ransmeier & Gerard, 1949).

When DFP was given to human patients over long periods, they complained of disturbed sleep and nightmares (Grob *et al.* 1947; Rowntree, Nevin & Wilson, 1950). In this connexion it is interesting to note that, in one of the first papers written on the pharmacological action of eserine, in 1876, Harnack & Witkowski describe how eserine injected into an epileptic idiot caused convulsions and, in addition, the idiot behaved as if he had had hallucinations. It is interesting to speculate, although we cannot do more at present, if these effects are the results of inhibition of cholinesterase and are brought about by accumulation of acetylcholine on the sensory side of the brain.

Duke, Pickford & Watt (1950) injected small amounts of DFP into the region of the supra-optic nucleus in dogs, and observed a profound and long-lasting inhibition of the rate of urine flow, followed by a diabetes insipidus lasting for a few weeks. We have seen that an injection of acetylcholine into this region causes the release of the antidiuretic hormone, and the delayed effect of DFP could be explained by its paralyzing action. The acetylcholine released by cholinergic nerve endings impinging on the supra-optic nucleus would no longer be destroyed and, by its persistence, would give rise to the paralyzing action. But we cannot discard the alternative explanation that paralysis is due to direct interference with the cell metabolism.

## 6. Mode of Action of Acetylcholine at the Central Synapse. Central Depressant Effects of Acetylcholine and Anticholinesterases

We may form an idea of how acetylcholine acts on the central nervous system from an analogy with its effect on motor end-plates of striated muscles or on cells of sympathetic ganglia. Acetylcholine depolarizes these structures. The depolarization can be recorded and is known as the motor end-plate potential (Göpfert & Schaefer, 1937; Schaefer & Haass, 1939; Eccles & O'Connor, 1939; Eccles & Kuffler, 1941; Eccles, Katz & Kuffler, 1941a, 1941b, 1942; Kuffler, 1943). Depolarization of the ganglion on preganglionic nerve stimulation has been recorded by Eccles (1943, 1944) and termed "synaptic potential"; a better name would be "ganglion potential". These potentials then give rise to the impulse or excitation wave along the fibre of the postganglionic nerve or muscle. Evidence in support of this view has been obtained from quite a different source (Beutner & Barnes, 1941, 1942). A model of a polarized surface with a lipid layer in contact with saline solution can be connected to an amplifier by leads applied to the two surfaces of the interface. A positive electromotive force may then be recorded. This quickly declines when minute amounts of acetylcholine are added to the saline solution.

Probably acetylcholine also depolarizes some surface of the nerve cell in the central nervous system and this depolarization then provides the appropriate stimulus for initiating the nerve impulse in the axon. This view enables us to understand why

stimulation is so often followed by depression, and why the latter is often observed more easily than stimulation. When acetylcholine acts as the physiological stimulus at central synapses, it is destroyed by the true cholinesterase the moment the acetylcholine is released; the surface thus becomes repolarized and ready for depolarization by a renewed charge of acetylcholine. With most of the methods of artificial application of acetylcholine, however, depolarization will persist for some time, because the large amounts of acetylcholine are no longer dealt with quickly enough by the normal protective mechanism of enzymatic destruction; in addition, depolarization will no longer be restricted to those relevant points where the nerve endings impinge on the cell; on the contrary, the whole cell may be "flooded" with acetylcholine. In order to understand how this can cause depression we may follow Sherrington's earlier suggestion and look upon transmission at the motor end-plates as furnishing a pattern or paradigm of what happens at the central synapse.

Acetylcholine may cause either contraction, depression or contracture of the skeletal muscle and all three effects can be explained by the depolarizing action of acetylcholine.

When released from the motor nerve-ending under physiological conditions, the only region which becomes depolarized by the acetylcholine is the motor end-plate. This depolarization furnishes the appropriate stimulus for the excitation wave along the muscle fibre and its subsequent contraction. This action of acetylcholine is represented diagrammatically in fig. 1a. But when a large dose of acetylcholine is injected into a muscle artery, contraction is often followed by depression. The same occurs with smaller doses of acetylcholine when its destruction is prevented by eserine or another anticholinesterase, as shown in fig. 2. Depression is seen also when the nerve to the muscle is frequently stimulated in the presence of eserine. Figures 2 and 3 illustrate the fact that eserine has two actions on the muscle contraction elicited by nerve stimulation; it potentiates the single twitch, but depresses the

FIG. 1

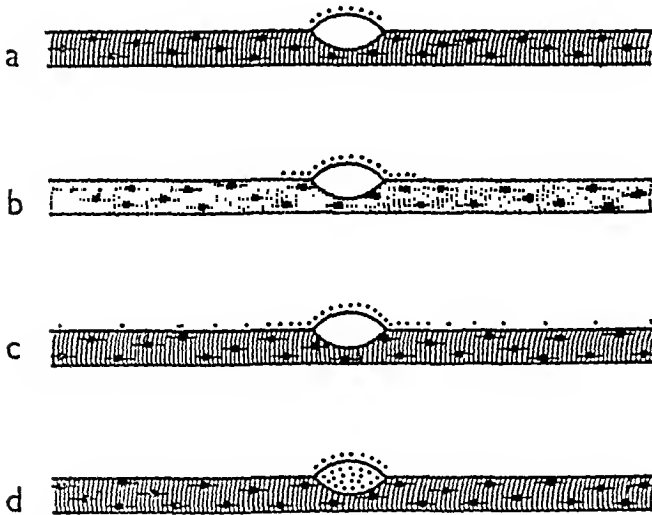
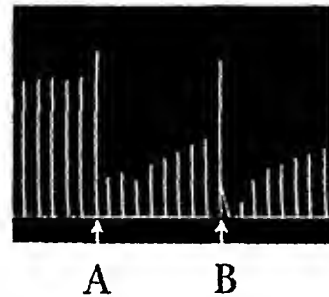


Fig. 1. Diagram of four skeletal muscle fibres with their end-plates, to illustrate the actions of acetylcholine. Depolarization shown by dots

a : the physiological stimulating action

b, c, d : three possible forms of the paralyzing action  
(For details, see text)

FIG. 2



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Fig. 2. Spinal cat.

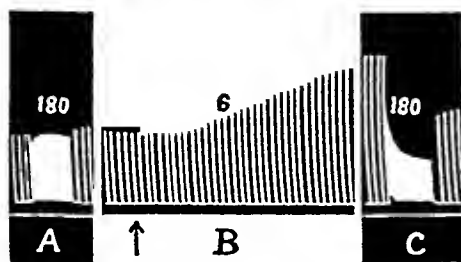
Contractions of gastrocnemius muscle in response to single maximal shocks to nerve at 10 sec. intervals, after arterial injection of 0.1 mg. of the anticholinesterase miotine

A : arterial injection of 10  $\mu$ g. acetylcholine

B : short tetanic stimulation of nerve

tetanus. The depression of the muscle responses is explained either by prolonged persistence of acetylcholine at the end-plate region or, more likely, by depolarization extending beyond this region to the muscle fibre. In the diagrammatic representation (fig. 1), depolarization beyond the end-plate region is indicated in b and c. It makes no difference for the purpose of interpretation whether this depolarization affects only a small region beyond the end-plate or the whole muscle fibre. In both conditions depression would result, because depolarization of the fibre, unlike that of the end-plate, does not give rise to an excitation wave but, on the contrary, forms an inexcitable region which blocks transmission. Thus, even depolarization of a minute part of the muscle fibre adjacent to the end-plate acts as a block, and would fully explain the phenomenon of the depressant action. Two facts support the view that, during the condition of acetylcholine depression, parts at least of the muscle fibre are depolarized: first, the finding that the reduced excitability applies not only to nerve stimulation but also, although to a lesser degree, to direct muscle stimulation (Brown, Dale & Feldberg, 1936); and second, the acetylcholine contracture. This phenomenon has not been sufficiently considered in the interpretation of the mode of action of acetylcholine. By a contracture we mean a form of contraction which develops more slowly than a twitch or tetanus; tension is not as high as that of a summated contraction; heat and lactic acid are produced; and that part of the muscle which is in a state of contracture becomes negative to the resting part, i.e., it is depolarized. Where it differs from the picture of normal contraction is in the conduction of the mechanical response and the propagation of excitation. In the state of contracture the muscle fibre is depolarized and electrically inexcitable; the contracture thus prevents propagation along the muscle fibre of excitation waves arising from the motor end-plate. This accounts for the depression of the response to nerve stimuli, a characteristic of muscles in contracture. When the contracture is localized in a muscle fibre it forms a region of neuromuscular block. Contractures and depression of response are therefore both signs of a depolarization of the muscle fibres.

FIG. 3



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Fig. 3. Cat, under chloralose anaesthesia

Contractions of tibialis anticus in response to maximal shocks to nerve at frequency of either 6 or 180 per min. At arrow, intravenous eserine 0.5 mg. per kg. bodyweight. The white patches are caused by overlapping of the individual contractions during high frequency stimulation

In denervated mammalian muscle, as well as in normal avian or amphibian muscle, acetylcholine causes typical contractures; in other words, depolarization of the muscle fibre beyond the end-plate region occurs. Similarly, Feng & Shen (1937) have shown that, for frog muscle, repeated nerve stimulation after eserine leads to a contracture restricted to the region near the end-plate, i.e. there is again depolarization beyond the plate region.

There is thus sufficient evidence to show that acetylcholine depolarizes at least part of the muscle fibre and that the depressant action is thereby explained. Nevertheless, prolonged persistence of acetylcholine at the end-plate region might itself produce depression. On this assumption, the persistence of acetylcholine would result in a derangement of the finely adjusted mechanism of depolarization and repolarization, which apparently is required for the proper functioning of the end-plate region. The condition is represented diagrammatically in fig. 1d. The phenomenon of depression can certainly be obtained in the absence of any muscle fibres as, for instance, in the electric organ of the torpedo fish. This organ consists of exaggerated electric plates, which are modified motor end-plates lacking the contractile fibre. The release of acetylcholine by the nerve impulse leads to depolarization of the ventral surfaces of the plates, which are quickly repolarized when the acetylcholine is destroyed by the true cholinesterase (Feldberg & Fessard, 1942). After eserine, however, the effect of repeated nerve stimulation becomes more and more reduced and may disappear. This "depression" is explained either by continued depolarization of the ventral surface of the plates, or by the fact that the released acetylcholine "floods" parts of the plate, perhaps even the dorsal surface which is normally not reached by the acetylcholine. The sequence of events at the electric organ thus provides no proof for the view that prolonged persistence of acetylcholine at the points of its physiological action is sufficient to produce a condition of depression.

The depressant actions of acetylcholine and anticholinesterases on the central synapses may be explained in a similar fashion; prolonged depolarization or "poisoning" by acetylcholine of parts normally depolarized for an extremely short period, or depolarization of regions of the cell which are normally not reached by the released acetylcholine and which may even extend to the beginning of the axon, may account

for the depression. We can now understand not only why the depressant actions are so prevalent with anticholinesterases but also why stimulant effects are so much more difficult to obtain than in skeletal muscle. In the latter, only the response to single nerve impulses is potentiated by eserine; the tetanic contraction obtained with repeated nerve stimulation is depressed, as seen in fig. 3. The continuous activity in the central nervous system, however, resembles not the single impulse but the repeated stimulation. It is thus not surprising that the anticholinesterases are central depressants; what is surprising is that they often exert central excitatory effects.

The central depressant actions of acetylcholine, and of anticholinesterases like eserine, thus present strong evidence for the acetylcholine theory of central synaptic transmission. This has not always been fully recognized.

The above considerations do not necessarily apply to the effects obtained with high concentrations of DFP, TEP or even of eserine. In these conditions we may be dealing, in part at least, with direct depressant actions not accounted for, or not wholly accounted for, by released acetylcholine.

## 7. Release of Acetylcholine

The release of acetylcholine on stimulation of the nerve has always provided the first and most important part of the evidence for the cholinergic nature of a peripheral nerve. The method has not had a wide application in the central nervous system. This is not surprising when we consider the difficulties inherent in perfusion experiments of this part of the body. But the few results so far obtained (for references see Feldberg, 1945b) support the acetylcholine theory of central synaptic transmission.

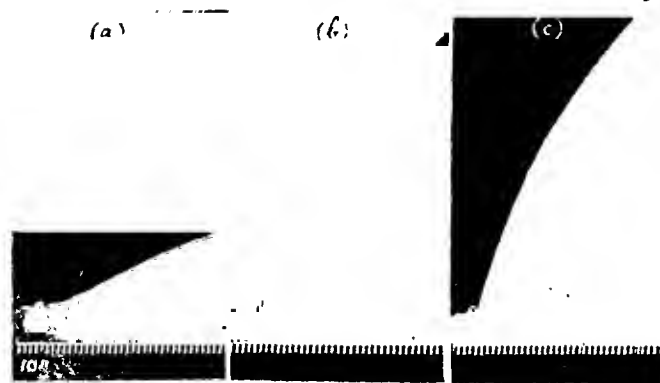
The central nervous system exhibits continuous activity; therefore acetylcholine should be released continuously in the absence of special external stimuli. It has, in fact, been found by all workers on this subject, that after eserine, acetylcholine appears "spontaneously" in the cerebrospinal fluid as well as in the venous effluent from the central system. In certain conditions, this spontaneous output increases, as for instance after central vagus stimulation, or stimulation of the sinus nerve, after asphyxia and, strangely enough, after administration of adrenaline. By far the most convincing evidence regarding increased release of acetylcholine as a result of increased central activity is given by Bülbring & Burn (1941). They perfused the lower half of the spinal cord of dogs with eserinated saline solution. Reflex activity persisted for eight minutes; during this period they stimulated the central end of the cut sciatic nerve and obtained an increased output of acetylcholine in the venous effluent. Figure 4, taken from their paper, shows the effect of effluent, collected before and during stimulation, on leech muscle.

## 8. Changes in the Acetylcholine Content

The problem of the acetylcholine content of the central nervous system has to take into account the following facts: (i) acetylcholine is present in the tissues in a bound form in which it is inactive and protected against enzymatic destruction; (ii) as soon as it is set free it is at once destroyed by true cholinesterase; (iii) the released acetylcholine is rapidly replaced by synthesis, the new acetylcholine being synthesized in the bound form.



FIG. 4



Reproduced from Bülbring & Burn (1941) by kind permission of the Editors of the *Journal of Physiology*

Fig. 4. Leech muscle

- a : effect of a control sample of venous effluent from spinal cord taken 3 min. after Ringer perfusion was started
- b : contraction produced by a sample collected after 2 min. stimulation of the central end of the sciatic nerve
- c : contraction produced by acetylcholine (1 in 50 million)

If destruction of the released acetylcholine and its replacement by synthesis were to proceed at the same rate, variations in the functional activity of the brain would produce no change in the acetylcholine content—even if these variations were associated with increased and decreased release of acetylcholine. The acetylcholine content of a given part of the central nervous system would have a constant value, determined probably by the number of available tissue constituents to which acetylcholine is bound. This view is correct to a limited extent only.

Most of the earlier experiments (for references see Feldberg, 1945b) which dealt with variations in the acetylcholine content of the central nervous system were undertaken without taking into consideration or making allowance for the fact that release, destruction and synthesis of acetylcholine take place very rapidly. It is therefore not surprising that the results were contradictory and anything but convincing.

However, recent experiments on rats carried out in the Neuropsychiatric Research Centre in Cardiff have shown that, if brain tissue is rapidly fixed, the level of its acetylcholine content shows variations dependent on the state of functional activity of the brain prevailing during the time of fixation (Richter & Crossland, 1949). Replacement by synthesis apparently does not keep pace with the release and destruction of acetylcholine.

In the experiments of Richter & Crossland the method of rapid fixation was that formerly used by von Murlt (1937) on peripheral nerves; i.e., the animals were killed by immersion in liquid air. The brains of rats killed during anaesthesia or sleep showed an increased acetylcholine content, those killed in emotional excitement or convulsions a decreased acetylcholine content. The changes were large but transient. The values for the convulsed animal were only 25–30% of those obtained in anaesthesia; when the animals were killed only a few seconds after electrically induced convulsions, the acetylcholine level had returned to its normal level. Even with the method of immersion in liquid air it took approximately 4 sec. for the brain to cool to 0° C.; with quicker methods of

fixation, still greater variations in the acetylcholine content might have been obtained.

## 9. Synthesis of Acetylcholine

There are different methods available for studying the synthesis of acetylcholine. When we incubate tissue slices or minced tissue, the enzyme is not in solution; the synthesis occurs in the slices or cell debris, and the acetylcholine is released from them and diffuses into the solution (Mann, Tennenbaum & Quastel, 1938, 1939). The method actually does not distinguish between synthesis and release. Glucose must be present in the incubation medium when this method is used, but the concentration necessary for optimal synthesis is only about 10% of that existing in blood. The normal concentration in the blood actually depresses synthesis or release.

If similar conditions prevail in the body, it means that the blood-glucose exerts normally a restraining effect on the continuous synthesis or release of acetylcholine in the central nervous system. Lowering the blood-glucose would remove the "glucose brake" and allow synthesis and release to proceed at an abnormal rate. The result would be the same as if acetylcholine had been applied to the motor cortex, i.e., convulsions would occur. Insulin convulsions might thus be explained on the acetylcholine theory of central synaptic transmission (Feldberg, 1945a, 1945b).

The hunger contractions of the stomach associated with a lowering of the blood-glucose might be interpreted as being due to a similar mechanism, i.e., removal of the glucose brake—partly in the stomach wall but mainly in the central nervous system—on the acetylcholine release, and synthesis at the nerve endings impinging on the vagal centres or at neurones situated higher up in the neural axis.

A great advance was made when it became possible to bring the enzyme for synthesis of acetylcholine into solution. This we owe to Nachmansohn & Machado (1943). They showed that the enzyme acts by acetylation of choline and that adenosinetriphosphate is necessary for the reaction. They termed the enzyme: choline acetylase. The experiments were performed on homogenized brain; later Feldberg & Mann (1944, 1945) used extracts from acetone-dried brain. The biochemical reactions involved in the synthesis are rather complicated and not yet fully understood (for references see Feldberg, 1950). For optimal synthesis of acetylcholine to take place in saline extracts prepared from acetone-dried brain, the following substances have to be added to the incubation medium: choline, adenosinetriphosphate, magnesium, potassium, cysteine, citrate, and activator or co-enzyme A. Eserine and sodium fluoride are added as well, as a precaution, in case traces of cholinesterase or phosphatase are still present in the extract. Cysteine is necessary in aerobic conditions in order to keep the SH groups of the enzyme reduced and active. The action of citrate is not clear; it may act as a source of acetate. The activator or co-enzyme A is a heat-stable, dialyzable substance present in extracts of brain and of many other tissues. According to Lipmann *et al.* (1947), it is a derivative of pantothenic acid; it appears to be the co-enzyme for acetylation in general and not for choline alone.

The great advantage of the use of acetone-dried tissue is that the amount of tissue required is small, so that determinations can be made with a few milligrams of tissue. Making

FIG. 5

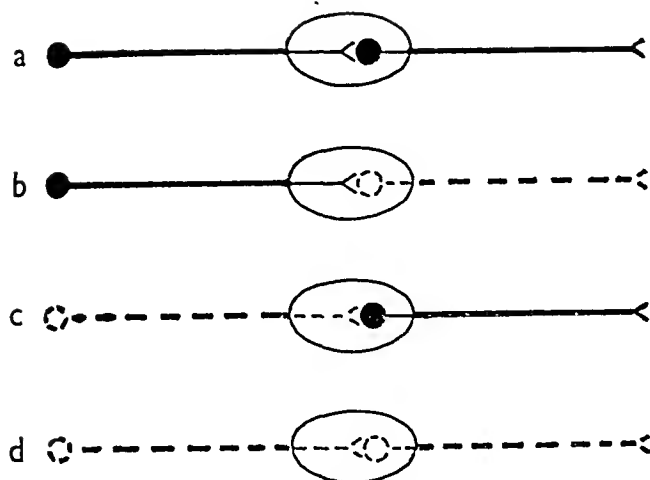


Fig. 5. Four possible arrangements (a, b, c, d) of cholinergic and non-cholinergic neurones at the synapse

● ——— cholinergic  
○ - - - - non-cholinergic

use of this fact, the synthesis of acetylcholine has been studied in various relatively well-defined areas of the central nervous system with the idea of mapping out the distribution of the enzyme, and on the assumption that acetylcholine is perhaps not the universal central synaptic transmitter, but that the central nervous system is built up of cholinergic and non-cholinergic neurones (Feldberg & Vogt, 1948). So far, these experiments have been confined to dogs. The acetylcholine-synthesizing power of a number of regions and tracts of the central nervous system was studied, but the results obtained seemed at first sight confusing. High and low values occurred in regions belonging to the same efferent or afferent pathway. However, by applying our knowledge of the properties of cholinergic neurones in the peripheral nervous system to the results, some interpretation became possible.

Assuming there are two kinds of neurones, then four connections are possible at the synapse, as indicated in fig. 5, and the following conclusions and approaches appear justified:

i. A cholinergic neurone is characterized by the fact that it synthesizes acetylcholine not only at its ending but along the whole course of its axon. Thus, a tract composed of cholinergic fibres will be identified by a high concentration of choline acetylase.

ii. On the other hand, a bundle of non-cholinergic fibres will be identified by the nearly complete absence of choline acetylase.

iii. Since the enzyme is apparently located in the axon and not in the myelin sheath, the thickness of the latter may affect the result. Thus, an intermediate value may not necessarily mean a mixture of cholinergic and non-cholinergic neurones. This introduces a difficulty, and interpretation depends largely on those less frequent regions with either high or low values.

iv. Concerning the grey matter, we must realize that the greyness is not so much determined by the nerve cell as by the abundance of non-myelinated fibres. The myelin sheath does not start at the very beginning of an axon, nor extend right to the end, as indicated diagrammatically in fig. 5. A

high value for synthesis of acetylcholine may thus indicate one of three possibilities: (i) the neurones of which the nerve cells form a part are cholinergic; (ii) only the fibres terminating at these cells are cholinergic; (iii) both are cholinergic. Therefore, a high concentration of enzyme in a region of grey matter does not necessarily imply that the enzyme is produced by the cell body or its axon. In the peripheral nervous system this fact is illustrated by the sympathetic ganglia, which contain cells of non-cholinergic neurones. More information can, therefore, be obtained if, in addition to the synthesizing power of the region of a nucleus, that of the tracts passing to and from the nucleus is known as well.

v. Occasionally, use can be made of our knowledge of the central actions of acetylcholine in the interpretation of the results. It is necessary to emphasize that the sensitivity of a nerve cell does not depend on whether or not it gives rise to a cholinergic axon; for instance, the sympathetic ganglion cells, which are the cell bodies of adrenergic neurones, are sensitive to acetylcholine. The reverse conclusion—that cells which respond to acetylcholine are cells upon which cholinergic neurones impinge—is more likely to be generally true.

With these facts in mind, an interpretation was attempted and it was found that often, although by no means always, the arrangement of neurones in the efferent and afferent nervous pathways was such that cholinergic and non-cholinergic neurones alternated with each other. For example, in the voluntary motor pathway, the finding of a high choline acetylase concentration in the anterior horns, in the motor nuclei of the cranial nerves and in the anterior roots suggests the cholinergic nature of the lower motor neurone. On the other hand, low values were encountered in the pyramidal tracts, indicating that the upper motor neurone is non-cholinergic. The fibres of the pyramidal tracts are not the only ones to impinge on the anterior horn cells. Fibres from other systems, some of which may be cholinergic, terminate at these cells. The same cell may, therefore, be impinged upon by cholinergic and non-cholinergic fibres. In the motor area of the cerebral cortex an intermediate value was found, which might suggest that cholinergic neurones converge on the pyramidal cells. This suggestion is strengthened by the fact mentioned earlier that both eserine and acetylcholine, when locally applied to the motor cortex, initiate impulses in the pyramidal tracts.

Evidence for a succession of alternating non-cholinergic and cholinergic neurones is also found in afferent pathways. Low values found for the posterior roots and their central continuation, the funiculi gracilis and cuneatus, are in agreement with the conception that the first neurone of the afferent sensory pathway is non-cholinergic. However, relatively high values were obtained for the nuclear masses in which these sensory fibres end; this was taken to indicate the cholinergic nature of the second neurone in the sensory pathway. More recently, in 1949, Feldberg, Harris and Lin examined tracts of secondary sensory neurones (unpublished work). Whereas the eighth cranial nerve itself lacked the enzyme, the trapezoid bodies and the lateral filament which contain the fibres of the second ascending neurone gave intermediate values. Similarly, the region of the spinal cord which contains, amongst other fibres, those from the spino-cerebellar tract, i.e., of the second ascending neurone, also gave intermediate values. The third sensory neurone, originating in the thalamus and leading to the cortex, is probably again non-cholinergic, as suggested by

the low values found for the fibres in the posterior part of the internal capsule which, at least in man, is said to contain the thalamic radiation.

Another example is provided by the optic pathway. The retina contains large amounts of choline acetylase, whereas the optic nerve is free from it. This suggests that acetylcholine is the chemical transmitter at one or more of the synaptic junctions in the retina, but that the optic nerve is non-cholinergic. Observations made in 1949 on *Sepia* by Feldberg, Harris and Lin (unpublished work) suggest that, in the squid at least, the first neurone originating in the retina is also non-cholinergic. In *Sepia*, the retina consists of one kind of visual element only, which may correspond to the rods, and the nerve fibres originating from these pass, without synaptic interruption, as retinal nerves out of the eye and into the optic ganglion. It was found that in *Sepia*, the retina and the retinal nerves lack choline acetylase, which is highly concentrated in the optic ganglion. It is tempting, but dangerous, to use these results for interpretation of results obtained on the mammalian retina. But it may well be that the high concentration of choline acetylase in the mammalian retina is solely accounted for by the presence of the short second neurones. In that case, the first neurone originating in the rods and cones would be non-cholinergic and the second neurone cholinergic. This neurone then impinges in the ganglionic layer on the cell bodies of the non-cholinergic third neurone, the optic nerve. The fourth neurone in the optic pathway may again be cholinergic, as indicated by the high values found for the lateral geniculate bodies, where this fourth neurone begins.

Very low values for choline acetylase were found in the tissue of the anterior and posterior pituitary gland, but the region of the supra-optic nucleus gave a high value. This suggests that the last neurone by which nerve impulses are conveyed to the posterior pituitary is non-cholinergic, but that the fibres impinging on the supra-optic nucleus are cholinergic; the fact that the cells of this nucleus are sensitive to acetylcholine (Pickford, 1947) is in agreement with this concept.

However attractive such a pattern of a succession of alternating non-cholinergic and cholinergic neurones may be, it would be dangerous to have a conception which is too simplified and diagrammatic. We must realize that, if there are two different kinds of neurones, then on purely statistical grounds there must be considerable alternation.

About the nature of the non-cholinergic neurones nothing definite is known. As Sir Henry Dale said at the 1948 meeting of the British Association: "It is difficult to suppose that synapses in the central nervous system can differ among themselves so fundamentally in function, that transmission at some should be cholinergic and at others involve no kind of chemical agent." (British Association, 1948).

Naturally one thinks of the transmitter for adrenergic nerves in the peripheral nervous system: adrenaline or nor-adrenaline. Another substance has recently been suggested by Hellauer & Umrath (1948). According to their results, the transmitter is an unknown vasodilator substance which is also responsible for antidromic vasodilatation, a possibility which had already been foreseen by Dale (1935). Destruction of this transmitter is thought to be an enzymatic process which can be prevented by strychnine in the same way as eserine inhibits cholinesterase. Strychnine convulsions would thus be explained; confirmation of these results is essential before it is possible to speculate on these startling results. Holton and Perry (personal communication, 1950), for instance, have recently shown that strychnine has no detectable effect on antidromic vasodilatation produced in the external ear of the rabbit.

Summarizing, it may be said that whatever conclusion we draw from each single finding, it is impossible to deny the fact that there is a great number of observations which can be accounted for convincingly and satisfactorily only by the acetylcholine theory, even if we agree that acetylcholine is probably not the universal central synaptic transmitter.

I find it difficult to understand the position taken up by several authors who discard all findings in favour of the acetylcholine theory as being irrelevant, but perhaps my difficulty is the result of bias and prejudice.

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## CONDUCTION OF THE NERVOUS IMPULSE: SOME RECENT EXPERIMENTS

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- 1 Experiments with internal electrodes
  - 2 The basis of the action potential: a hypothesis
  - 3 Tests of the hypothesis
    - a Action of sodium-free solutions
    - b Effects of changes in the external concentration of sodium
    - c Ionic exchange during activity
  - 4 Saltatory conduction in medullated nerve
- References

The centenary of the discovery of the action current by Du Bois-Reymond and Matteucci<sup>1</sup> has passed almost unnoticed by the majority of physiologists and biophysicists. But formal recognition of this event is hardly necessary, for the discovery forms the basis of most modern work on the nervous system and its importance is as clear today as it was a hundred years ago. For a long time progress was limited by the lack of suitable recording instruments, and precise information could be obtained only by the use of ingenious but indirect methods such as those employed by Bernstein (1868) or Lucas (1912).

In recent times the development of valve amplifiers and cathode-ray tubes has provided an almost perfect method of measuring rapid electrical changes. With these instruments, an observer can be sure that the electrical variations which reach his recording system are reproduced without appreciable distortion. But this is not by any means the end of the story, for it does not follow that the changes at the recording electrodes are the same as those at the active surface of a nerve or muscle fibre. Excitable cells are always surrounded by a certain amount of external fluid and the potential difference observed with external electrodes depends to a large extent upon the shunt provided by the external fluid. Another complication is introduced by the interesting phenomenon of dispersion. A mixed nerve trunk consists of many thousands of nerve fibres with diameters varying over a wide range. The conduction velocity of a nerve fibre increases with its diameter so that the action potential of a mixed nerve trunk is a compound wave which is built up from the asynchronous activity of large numbers of different fibres (Erlanger & Gasser, 1937). It is therefore a matter of some difficulty to make quantitative deductions about the behaviour of a single nerve fibre from observations with large nerve trunks.

<sup>1</sup> According to Biedermann (1896) the discovery was made independently by Du Bois-Reymond and Matteucci between the years 1840 and 1843. Full references to the literature of this period are given in Du Bois-Reymond's *Untersuchungen über thierische Elektrizität* (1848).

Errors may also be introduced by irregularities in the nerve trunk or by the presence of an external connective-tissue sheath. The position can be improved by using an isolated nerve fibre, but it is still necessary to allow for the shunting effect of the external fluid and this can be done only by making complicated electrical measurements.

### 1. Experiments with Internal Electrodes

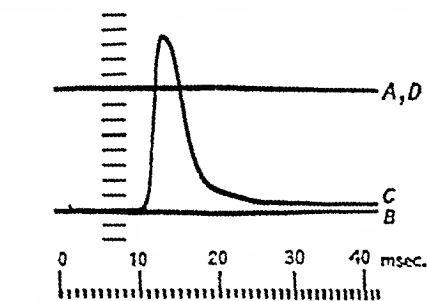
The most satisfactory method of determining the absolute magnitude of the action potential depends upon the use of an internal electrode which measures the potential difference across the cell surface. This technique has been used to measure the resting potential and action potential in the giant axon of the squid (Curtis & Cole, 1940, 1942; Hodgkin & Huxley, 1939, 1945). The methods employed by American and British investigators differ in certain minor respects, but the general principle is the same. A micro-electrode consisting of a long glass capillary is inserted at one end of the fibre and is pushed in for a distance of 10–30 mm. During this process it is important to keep the micro-electrode in the centre of the axon. If the electrode scrapes against the surface membrane it damages the fibre and the experiment is at an end; but if kept in the centre it appears to do no harm and the axon remains excitable for many hours.

The small size of most nerve and muscle fibres makes it difficult to use the technique employed for the giant axon, but another method has now been developed by a group of physiologists in Chicago (Graham & Gerard, 1946; Ling, 1948; Ling & Gerard, 1949a, b, c, d). These workers showed that a very small electrode can be inserted transversely into a muscle fibre without causing appreciable damage or twitching. The surface membrane appears to form an effective seal round the electrode, provided that the dimensions of the latter are sufficiently small. In order to obtain successful results it is desirable that electrodes should have an external tip diameter of not more than 0.5  $\mu$ . This small diameter means that the electrodes have a high electrical resistance and special precautions must be taken with the recording system. Gerard and his collaborators were primarily interested in the resting potential and made no direct measurements of the action potential. Further developments in technique have made it possible to record both action potential and resting potential with this type of electrode (Hodgkin & Nastuk, 1949; Nastuk & Hodgkin, 1949, 1950). Other investigators are now extending the method to different preparations (e.g. Coraboeuf & Weidmann, 1949) and it may prove to be an important way of investigating cells and tissues which are not amenable to more conventional methods of attack.

Two general conclusions may be drawn from the experiments with internal electrodes. In the first place, it is clear that both action potential and resting potential are developed across a thin membrane at the surface of the fibre. There was already much evidence for this conclusion, but the experiments with internal electrodes put it on a firmer basis. In this respect modern work substantiates the assumptions made in the classical form of the membrane theory, but in another respect it comes into sharp conflict with the predictions of the theory. For it is found that activity does not consist of a simple membrane break-down, but involves a substantial reversal of the membrane potential. Thus the resting potential of squid nerve is about 50 mV., while the action potential may be 100 mV. or more (Curtis & Cole, 1942;



FIG. 1. RESTING POTENTIAL AND ACTION POTENTIAL OF FROG MUSCLE FIBRE



(From Nastuk & Hodgkin (1950), by permission of the Editors of the *Journal of Cellular and Comparative Physiology*)

Temperature 6° C.

Ordinate scale : 10 mV. steps (from voltage calibrator)

Record A : obtained at beginning of experiment, with micro-electrode outside fibre

Record B : obtained in the resting condition, with micro-electrode inside fibre

Record C : obtained in stimulated condition, with micro-electrode inside fibre

Record D : obtained at end of experiment, with micro-electrode outside fibre

Hodgkin & Huxley, 1945; Hodgkin & Katz, 1949). The average resting potential in frog's muscle is about 90 mV., while the action potential is about 120 mV. (Hodgkin & Nastuk, 1949). A typical record which illustrates the reversal of potential difference in frog muscle is shown in fig. 1. There is evidence for a similar reversal in crustacean nerve (Hodgkin & Huxley, 1945) and it appears to be a fairly general property of excitable cells. Recent experiments suggest that the effect may have an interesting explanation in terms of permeability and ionic concentrations.

## 2. The Basis of the Action Potential : a Hypothesis

Table I gives approximate figures for the ionic concentrations in the interior of a frog's muscle fibre and in the surrounding Ringer's fluid. The figures illustrate the well-known result that inside the cell potassium is present in

TABLE I. APPROXIMATE IONIC CONCENTRATIONS IN FROG MUSCLE

Myoplasm	Ringer's Fluid
(K) <sub>i</sub> = 125	(K) <sub>o</sub> = 2.5
(Cl) <sub>i</sub> = 1-5	(Cl) <sub>o</sub> = 117
(Na) <sub>i</sub> = 15	(Na) <sub>o</sub> = 117
Internal Anions = 135	
Membrane	

Concentrations are given in milliequivalents per litre and are based on information provided by Boyle & Conway (1941). The figures given for Ringer's fluid are those used in the experiment illustrated by fig. 1 (see Nastuk & Hodgkin, 1950).

high concentrations, while sodium and chloride are present in low concentrations. We shall assume that the resting mem-

brane is permeable to potassium and to chloride but is sparingly permeable to sodium and to the internal anions (cf. Boyle & Conway, 1941). Under these conditions a potential difference of the same sign and order of magnitude as the resting potential is to be expected. Owing to the direction of the concentration gradients, potassium ions tend to leave and chloride ions to enter the fibre. In this way a potential difference is built up which opposes further motion of ions. If the membrane were permeable to potassium ions alone we should have :

$$E_K = 58 \text{ mV. } \log_{10} \frac{(K)_i}{(K)_o} \quad (1)$$

where  $E_K$  is the equilibrium potential for potassium;  $(K)_i$  and  $(K)_o$  are activities inside and outside the fibre. On the assumption that the activity coefficient inside the fibre is the same as that outside we find  $E'_K = 99 \text{ mV.}$  for the system considered in Table I. If the membrane were permeable to chloride ions alone we should have :

$$E_{Cl} = 58 \text{ mV. } \log_{10} \frac{(Cl)_o}{(Cl)_i} \quad (2)$$

$$E'_{Cl} = 80 \text{ to } 120 \text{ mV.}$$

The combined effect of potassium and chloride would therefore be to give a potential difference of about 100 mV., which is of the same order as that observed in isolated muscle. It is clear that maintenance of the resting potential ultimately depends on metabolism, but we know very little about the intervening links in this process. Recent work suggests that a fraction of the metabolic energy may be directed towards an active extrusion of sodium (Krogh, 1946; Ussing, 1949). A process of this kind would prevent equalization of ionic concentrations and might also have the temporary effect of raising the membrane potential above that required by equations (1) and (2). There must be many other ways in which metabolism might contribute to the resting potential, but this does not reduce the importance of the potassium and chloride systems, which may be conveniently regarded as a storage battery in parallel with a metabolic source of energy.

In the classical form of the membrane theory it is assumed that excitation leads to a loss of the normal, selectively permeable, character of the membrane. If this is so the membrane potential would fall towards zero during activity and there would be no reversal of membrane potential. In order to account for the reversal it will be assumed that the membrane becomes highly and specifically permeable to sodium. In this case sodium ions would tend to enter the fibre faster than potassium ions could leave it and a reversed potential difference would be established. If the membrane became infinitely permeable to sodium its potential should approach the equilibrium potential for a sodium electrode :

$$E_{Na} = 58 \text{ mV. } \log_{10} \frac{(Na)_i}{(Na)_o} \quad (3)$$

$$E'_{Na} = -52 \text{ mV.}$$

We should not expect to find such a large reversal of membrane potential unless the degree of selective permeability were very great. It is therefore reassuring to find that the average values in muscle and squid nerve appear to be less than the maximum predicted by equation (3) (Nastuk & Hodgkin, 1950; Hodgkin & Katz, 1949).

### 3. Tests of the Hypothesis

One advantage of this hypothesis is that it can be tested experimentally in a number of different ways. If the active depolarization of a nerve or muscle fibre is due to entry of sodium, it follows that conduction of impulses should be impossible in sodium-free media.

#### a. Action of Sodium-free Solutions

The action of sodium-free solutions was studied by Overton (1902) and has been the subject of recent investigations by Lorente de N  (1944, 1947, 1948, 1949a, b) and others (Kato, 1936; Erlanger & Blair, 1938; Webb & Young, 1940; Katz, 1947; Hodgkin & Katz, 1949; Nastuk & Hodgkin, 1950; Huxley & St mpfli, 1949). There appears to be general agreement that most excitable tissues become reversibly inexcitable when immersed in solutions which do not contain sodium, lithium or certain quaternary ammonium ions. Single nerve fibres from amphibia and crustacea become inexcitable within a few seconds of application of an isotonic sodium-free solution; excitability can be restored by solutions containing sodium in a similar space of time (Hodgkin & Katz, 1949; Kato, 1936). In other preparations, such as frog muscle or the giant axon of the squid, the time required for excitability to disappear may be somewhat longer, but is still of the same order as that predicted on a diffusion basis (Hodgkin & Katz, 1949; Nastuk & Hodgkin, 1950). A frog's sciatic nerve retains its excitability for many hours in a sodium-free solution and there is some difference of opinion about the reason for this. One possibility is that appreciable quantities of salt may be retained in the interstitial spaces as a result of slow diffusion through the epineurium (see Rashbass & Rushton, 1949a, b), but this view is not universally accepted (see Lorente de N , 1947). In general, it may be said that the experiments with isolated nerve fibres support the sodium hypothesis while those with multifibre preparations are still the subject of controversy.

#### b. Effects of Changes in the External Concentration of Sodium

Another consequence of the hypothesis is that the relative magnitudes of the action potential and resting potential should depend upon the concentration of sodium in the external fluid. Thus the active membrane should be unable to give a reversed potential difference if the concentration of sodium in the external fluid were made equal to the internal concentration. The effect of alterations in sodium concentration has now been studied in the giant axon of the squid (Hodgkin & Katz, 1949) and in frog's muscle (Nastuk & Hodgkin, 1949, 1950). In both cases it was found that the magnitude of the reversed potential difference varied with the sodium concentration, in the general manner demanded by the hypothesis. It was also shown that the difference between the action potential and resting potential was increased by solutions containing an excess of sodium. Another interesting point is that the rate of rise of the action potential could be varied over a wide range by changing the external concentration of sodium. This result is clearly consistent with the idea that the active depolarization of a nerve fibre is due to entry of sodium.

#### c. Ionic Exchange during Activity

A more direct test of the hypothesis has recently been made by Keynes (1949), who has studied the penetration of  $\text{Na}^{24}$

into *Sepia* axons. He found that stimulation at 100/sec. caused a fifteenfold increase in the rate of uptake of  $\text{Na}^{24}$ . There was also a considerable increase in the outward passage of  $\text{Na}^{24}$ , so that it was difficult to decide whether or not activity was associated with a net uptake of sodium. But it seems clear that activity must involve a substantial increase in the permeability to sodium.

The experiments with sodium are closely linked with recent experiments on potassium leakage. Earlier work indicated that activity is associated with a loss of potassium (Cowan, 1934; Fenn & Cobb, 1936; Young, 1938; Arnett & Wilde, 1941) and this finding has now been put on a more quantitative basis. Using an indirect method, Hodgkin & Huxley (1947) estimated that about  $1.7 \times 10^{-12}$  mol. of potassium pass through 1 cm.<sup>2</sup> of membrane in one impulse in *Carcinus* axons. Using radioactive tracers, Keynes (1948, 1949) reports a potassium loss of  $2.1 \times 10^{-12}$  mol. per cm.<sup>2</sup> per impulse in *Carcinus* and  $4.5 \times 10^{-12}$  in *Sepia* axons. It is possible that most of the potassium is lost during the falling phase of the action potential and that this loss balances a corresponding entry of sodium during the rising phase. (There is also likely to be some simultaneous exchange of Na and K.) If this view is correct, it follows that the immediate source of energy for the nervous impulse is the exchange of a minute amount of sodium and potassium ions. It is important to remember that the quantities involved are extremely small. Thus the amount of potassium which leaves a 200  $\mu$  *Sepia* axon during one impulse is of the order of  $\frac{1}{100,000}$  of the total internal potassium. A large nerve fibre should therefore be able to live on its ion store for some time. However, sooner or later the axon must pump out the sodium which leaks in and reabsorb the potassium which it has lost. In this connexion it is interesting to recall that the human erythrocyte appears to be able to extrude sodium (Harris, 1941) and that here there is some evidence to show that sodium extrusion is the active process and potassium absorption is a passive counterpart (Maizels, 1949). If this idea is correct it may simplify the position, since only one secretory system need be considered. But the problem is still a formidable one and no satisfactory hypothesis has yet been put forward.

### 4. Saltatory Conduction in Medullated Nerve

It would be inappropriate to close this article without referring to recent work on conduction in medullated nerve. There is now a considerable body of evidence to show that conduction in all excitable fibres is brought about by local electric circuits (e.g., Osterhout, 1931; Auger, 1933; Hodgkin, 1937a, b, 1939; Tasaki, 1939b). In muscle and in non-medullated nerve these local circuits spread in a continuous manner and conduction appears to be a perfectly uniform process. On the other hand, medullated nerve fibres show characteristic discontinuities at the nodes of Ranvier, and Lillie (1925) suggested that the high conduction velocity of these fibres might be due to the fact that they conduct in a saltatory manner. On this view the thickly myelinated internodes act as segments of inert cable which allow the impulse to skip from one node to the next with relatively small delay. In recent years much evidence has accumulated in favour of the hypothesis. On the one hand, there are a number of experiments which show that agents block most easily at the nodes of Ranvier (Erlanger & Blair, 1934, 1938; Kato,

1936; Tasaki, Amikura & Mizushima, 1936); on the other, there are experiments which indicate that electric currents stimulate at the nodes of Ranvier (Kubo, Ono & Toyoda, 1934; Kato, 1934, 1936; Tasaki, 1939a; see also von Muralt, 1945). Huxley & Stämpfli (1949) have now subjected the hypothesis to a rigorous test by analyzing the distribution of current in an active fibre. They find that the internodes act as passive, cable-like structures, while the inward current associated with activity is confined to the nodes of Ranvier. This constitutes strong evidence for the saltatory theory; but there remains the difficulty that the myelinated fibres of the central nervous system are commonly supposed to possess no nodes of Ranvier. If this were true, saltatory conduction would be impossible in central fibres and unlikely in the periphery. However, both Cajal (1899) and Bielschowski (1928) described nodes in the central nervous system and their existence has recently been demonstrated by a variety of methods (Hess & Young, 1949; Feindel, Allison & Weddell, 1948; Allison & Feindel, 1949).

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## CEREBRAL RESPONSES TO NERVE STIMULATION IN MAN

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- 1 Cerebral responses to electrical stimulation
    - a Responses in a patient with myoclonus
    - b Detection of small responses
    - c Responses in healthy subjects
  - 2 Afferent nerve fibres concerned in the responses
  - 3 Recording of action potentials in afferent nerve fibres
  - 4 Excitability of afferent nerve fibres concerned
  - 5 Variations in cerebral responses
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The somatic sensory receiving areas in the brains of animals have been mapped by Marshall, Woolsey & Bard (1941) and by Adrian (1941), with particular attention to the results of stimulating cutaneous sensory receptors. Less attention was given to the effects of stimulating proprioceptors, though Adrian mentioned that a prolonged stretching of a muscle caused only a brief discharge in the white matter deep to the sensory cortex. Woolsey, Chang & Bard (1947) stimulated posterior nerve roots electrically, which presumably excited proprioceptive as well as cutaneous sensory afferent fibres, and then found potential changes in the motor cortex precentrally as well as in the postcentral sensory areas. They reported that "the distribution of the precentral responses for various roots supplying the leg suggest that the afferent impulses terminate in a definite way in relation to the pattern of representation in the motor area." Localized modification of the spontaneous activity in the cortex of monkeys was reported by Gay & Gellhorn (1949), who stimulated proprioceptors on the opposite side of the body, and found that the effect was greatest in the particular area of the precentral region related to the part in which muscles were stretched.

### 1. Cerebral Responses to Electrical Stimulation

#### a. Responses in a Patient with Myoclonus

Investigations on a patient subject to severe myoclonic seizures (Dawson, 1947b) showed that a large cerebral electrical response could be detected on the scalp after a tap on a tendon or after electrical stimulation of a peripheral nerve. In this patient the responses to stimulation of the arm or leg showed the same distribution in a lateral direction as would be expected in the sensory or motor areas, but in an anteroposterior direction the electrical maximum lay on a line approximately 3 cm. in front of the surface marking of the central sulcus. At post-mortem examination Dr. Greenfield confirmed that this line lay in front of the central sulcus. The question then arose as to whether the response in this

subject indicated the normal site of arrival at the cortex of proprioceptive impulses, and was abnormal only in being so large as to be easily detectable, or whether the position in which the activity was greatest was also abnormal. An investigation was therefore begun to see if similar stimuli would produce detectable responses in healthy people.

#### b. Detection of Small Responses

During the investigations on the patient with myoclonus some difficulty was experienced in measuring the latency of the responses after the stimuli. This difficulty was caused by irregularities in the base-line of the records, due largely to spontaneous brain activity or activity of scalp muscles and to a small extent to random fluctuations in the amplifiers. When a number of records were superimposed with the stimulus artefacts coincident, features occurring at a constant time after the stimulus appeared more clearly, whilst those not regularly related to it produced only a general thickening of the base-line. The start of the response could then be identified more easily and timed more accurately. In the same way it was found that regular deflections in the records, previously too small in relation to the background to be considered significant, could now be detected with certainty. A similar technique was used in radar for detecting signals which were small in relation to random disturbances or interference, and an example of its use is given by Bradfield, Bartlett & Watson (1946). The principle of the method is essentially the same as that used by Francis Galton in 1875 (Galton, 1883), to bring out the features which were common to a number of portraits and to suppress the irregularities which were present only in individual pictures. The value of applying the method to the present work was realized as a result of discussion with Dr J. A. V. Bates, who has also used it for investigations to which reference will be made later.

#### c. Responses in Healthy Subjects

By the use of the technique described above, it was found that responses to electrical stimulation of peripheral nerve were detectable on the scalps of healthy people (Dawson, 1947a). These responses had the same distribution in a lateral direction as those produced by the same type of stimulation in the patient with myoclonus, but they were only one-fifth to one-tenth as large; they seemed also to be centred, in an anteroposterior direction, nearer to the surface markings of the central sulcus than the responses in the subject with myoclonus. The centre of the disturbance was taken as being deep to the place on the scalp where the potential gradients, plotted with a row of electrodes separated by 3 cm., changed in sign. This is the method described by Adrian & Yamagiwa (1935) and, so long as the potential gradients are symmetrical about the point of reversal, it gives a reliable indication of the position of the centre of the underlying electrical disturbance. In the coronal plane this condition was approximately fulfilled, and it is probable that the location of the area active in the responses, both in the patient with myoclonus and in healthy people, was accurate to within 2 cm. in either direction in this plane. In a sagittal plane the location in healthy people was less satisfactory as, although there was a maximum over the surface marking of the central sulcus, the potential gradients in front of this and behind it were not at all symmetrical. Up to the marking of the sulcus, from a point 6 cm. in front, the gradient was steep,

whilst behind the sulcus it fell only slowly; so the centre of the disturbance was probably not under the marking of the sulcus, although this was where the gradient reversed. An asymmetrical distribution of potential such as this may be accounted for in a number of ways. Of the possible hypothetical arrangements some are not physiologically unreasonable, and these include disturbances either behind or in front of the marking of the central sulcus. Hence it seems that the present methods will not allow accurate location in the sagittal plane of the site of arrival of the afferent volleys in the healthy subject. Although it was not found possible to determine where the activity was centred in the sagittal plane in healthy people, it was clearly differently distributed from that in the subject with myoclonus. It therefore remained important to determine whether or not the nerve fibres which were being stimulated in the two cases, and which were mediating the responses, were the same.

## 2. Afferent Nerve Fibres Concerned in the Responses

Clinical examination of the patient with myoclonus showed that the adequate stimulus for evoking the jerks was stretching of muscle and that light touch and pin-prick were ineffective in doing so. Electrical stimulation of a mixed nerve in this patient would evoke the cerebral responses, almost unreduced in size, when the shocks were so weak that few motor fibres were being excited. It seemed that the fibres concerned had a lower mean threshold to this form of stimulation than had the motor fibres, and that therefore they probably conducted more rapidly and were of larger diameter than the motor fibres. The group of nerve fibres which conduct most rapidly and have the lowest threshold to electrical stimulation contains fibres carrying impulses from stretched muscle and also, as has been shown by Kugelberg (1944), fibres mediating the sensation of touch. The peculiar power of stretching muscle for producing the responses in the patient with myoclonus, and also the fact that no responses were detected after stimulation of a purely cutaneous nerve, suggested that impulses in proprioceptive fibres from muscle were chiefly concerned. In healthy people on the other hand there was no clinical evidence that proprioceptive stimuli were more potent than any other kind, and the cerebral responses in them to stimulation of a mixed nerve might have been produced by volleys in cutaneous fibres as well as those from muscle. The experiments to be described, designed to test this point, were carried out with Dr J. W. Scott of Toronto. A comparison was made between the effects of stimulating the skin of the thumb and fingers and stimulating the trunk of the median or ulnar nerve through the skin at the wrist. The stimuli were applied to the skin of the hand by placing the thumb in one beaker of saline and the four fingers in another, with the stimulating current passed between the two beakers. It was found that a strength of shock which produced a just perceptible sensation and no sign of muscular twitching in the hand would produce a detectable cerebral response. In this experiment stimulation of some afferent fibres from muscles by spread of the stimulating current might still be occurring. However, the great increase in the shock—enough for it to become very unpleasant in the thumb and fingers—which had to be made before any twitching occurred in the small muscles of the hand suggested that the amount of such spread was probably insignificant with the weaker shocks. Since stimulation of the skin in healthy

people produces a cerebral response it seems likely that the response to stimulation of a mixed nerve is also in part due to a volley in cutaneous afferent nerve fibres. In the patient with myoclonus the responses to stimulation of proprioceptors were large and relatively smaller amplifications were used; this may perhaps explain the failure to find responses when cutaneous nerves were stimulated.

In the healthy subject, when the strength of the shock to the thumb and fingers was increased until it was very uncomfortable, and when the small muscles of the hand were twitching slightly as a result of spread of the current, the cerebral response remained smaller in many of its phases than the response which could be produced by stimulating the median, or even the ulnar nerve, at the wrist. This was so when the shock to the nerve was only just maximal for the motor fibres and was not at all uncomfortable. Figure 2 shows in A the cerebral responses to fifty stimuli applied at one-second intervals to the ulnar nerve at the wrist and just strong enough to be maximal for motor fibres. The records in B show the responses to fifty stimuli applied to the thumb and fingers with the shock as strong as the subject could bear. In C are shown the responses to 50 stimuli, applied to the thumb and fingers, which were only just above the threshold for producing sensation. The initial phases of the responses in records A and B are little different in size, but the later phases in A, where the stimulus was applied to the ulnar nerve, are significantly larger than those in B, where the stimulus was to the skin. A strong shock to the skin of the thumb and fingers would be expected to excite a greater area of cortex than would stimulation of the ulnar nerve at the wrist. If the area of active cortex was greater and it was excited synchronously, the change of potential picked up on the scalp with relatively widely spaced electrodes should also be increased; but any such difference in the area of cortex active was not apparent from records such as those shown in fig. 2, A and B.

## 3. Recording of Action Potentials in Afferent Nerve Fibres

In interpreting the findings described above, little importance may be attached to the size of the cerebral response unless something is known about the characters of the volley of impulses produced by each type of stimulation. It was found that, when the median or ulnar nerve was stimulated at the wrist, the action potential which resulted could be recorded from surface electrodes on the skin over the nerve above the elbow; similarly the action potential which followed the stimulus to the thumb and fingers could also be recorded. The methods used for making these records have been described elsewhere (Dawson & Scott, 1949) and by using them it was possible to obtain some information about the nerve volleys produced by stimulation at the different sites. (Similar methods, which were described by Eichler (1937), had not come to the authors' attention when this work was done.) When the shock to the nerve at the wrist is strong enough to stimulate motor fibres, the centripetal volley will contain antidromic impulses in these fibres, in addition to impulses in sensory fibres of the same and lower threshold. Therefore, when the action potentials are used to compare the activity in sensory fibres produced by different stimuli, allowance must be made for this antidromic volley whenever the stimulus may also be exciting motor fibres. With a stimulus which was



maximal for motor fibres it was shown (Dawson & Scott, 1949) that 70 per cent of the amplitude of the action potential in the nerve was due to impulses in sensory afferent fibres with a lower threshold than that of motor fibres. The remaining 30 per cent was due partly to antidromic impulses in motor fibres and partly to impulses in sensory fibres with the same threshold as motor fibres. Thus when the effects of stimuli to the hand and at the wrist are to be compared, not more than 30 per cent need be deducted from the amplitude of the volley caused by the stimulus to the nerve at the wrist, if the stimulus is exciting motor fibres. After such an allowance had been made the nerve action potential produced by stimulating the thumb and fingers was found to be half the amplitude of that which occurred after stimulating the nerve at the wrist. The action potential from the stimulus to the hand was also 30 per cent longer in duration and had a flatter top than that due to the nerve stimulus. The difference in the size of these two nerve action potentials may have been due to the fact that the stimulus to the hand was exciting only cutaneous afferent fibres, whilst the stimulus to the nerve was also exciting afferent fibres from muscles. But another possible cause of the difference may have been the temporal dispersion of the impulses in the volley, which is indicated by the greater duration and flatter top of the action potential following the skin stimulus. Either or both of these peripheral differences in the results of stimulation of skin or nerve trunk might account for the differences in the appropriate cerebral response.

#### 4. Excitability of Afferent Nerve Fibres Concerned

Experiments have been made to investigate the threshold to electrical stimulation of the nerve fibres chiefly concerned in producing the cerebral responses under consideration. In fig. 1, where one such experiment is illustrated, trace 1 is a time-scale showing 1, 5 and 20 msec. intervals, trace 2 is a record of the cerebral response made from electrodes placed as shown in the diagram, and trace 3 is a record of the action potentials in the left median nerve above the elbow. Trace 4 is a time-scale for trace 3 in 0.1 and 1 msec. intervals and the relative timing and duration of traces 3 and 4 to that of traces 1 and 2 is shown by the notch in trace 1. In A, 50 records have been superimposed without any stimulus being applied to the nerve. In B, an electrical stimulus, strong enough to be maximal for motor fibres, was applied to the median nerve at the wrist once a second, and again 50 records were superimposed. From C to H the shock strength was progressively reduced and it can be seen that the nerve action potential decreases in size more rapidly than the cerebral response. Allowing for the falling out of the action potentials due to antidromic impulses in motor fibres, which would be complete at the shock strength used in record D, these records suggest that the cerebral responses which are being considered are produced mainly by the fibres of lowest threshold in the nerves being stimulated. Of these low-threshold fibres some at least are cutaneous in origin. This is suggested by the fact that with the strength of stimulus used for the records in fig. 1G, and even with the weaker stimulus used in H, which did not produce a detectable cerebral response, the subject reported sensations referred to the peripheral distribution of the median nerve. From the present experiments it is not clear how much of the cerebral response

is due to stimulation of these low-threshold cutaneous afferent fibres and how much to stimulation of proprioceptive afferents from muscle. The small size of the cerebral response in record G, when the subject could detect some sensation which was diffusely scattered in the median nerve distribution, suggests that these methods are not likely to be useful for the study in man of the responses to localized tactile or other stimuli.

#### 5. Variations in Cerebral Responses

The use of the technique of superimposing many records of the cerebral response gives a mean form, which would otherwise be difficult to obtain on account of the irregularities in the records. But the method has the disadvantage of masking variations in the size or form of the responses to successive stimuli. A series of records, shown in fig. 3, made during the same experiment as those in fig. 1, but recorded individually instead of being superimposed, shows great apparent variations in the size of the cerebral response. The stimulus, which was of the same strength as that used for the records shown in fig. 1B, was applied to the median nerve at one-second intervals. From the records shown in fig. 1 it was known that when the nerve action potential was reduced by 20 per cent below maximal the mean amplitude of the cerebral responses changed by less than the differences between the individual responses in fig. 3. Since the nerve action potentials in fig. 3 were maximal and varied by less than 10 per cent it seems likely that the variations in size of the cerebral responses recorded in that figure were therefore not caused by any variations in the size of the afferent volleys. Much of the apparent variation of the cerebral responses in fig. 3 was probably due to inadequate relaxation of the subject in this experiment, which produced some irregularity of the base-line. This seems less likely to have been the cause of the variations between the responses in the series of records shown in fig. 4, since the subject was more relaxed in this experiment. In these records the shocks used were applied at one-second intervals and it appears that either the first or the later waves may vary in size or be completely absent. Variations of this kind in the responses to sensory stimuli have been shown to occur in animals (Marshall *et al.* 1941) as a result of cortical activity evoked by a preceding stimulus; but no regular relation between the spontaneous brain activity and the size of the responses to the stimuli was observed. On the other hand, Adrian & Moruzzi (1939) have shown in animals that the activity of the cortical cells discharging into the pyramidal tract is modulated in time with the spontaneous cerebral rhythms in the motor area during dial anaesthesia. In the subject from whom the record in fig. 4 was made, a pair of electrodes 3 cm. apart on the scalp over the sensorimotor area picked up—when the eyes were closed—a considerable amount of activity at 11 cyc./sec., which was apparently spread of occipital alpha rhythm. Whether this spread was a purely passive one, or an active neuronal spread more likely to modulate the activity of the cells concerned in the cerebral responses to stimulation, was not clear, but it seemed worth while to study the effects of applying the electrical stimuli at fixed times in relation to the phases of the alpha rhythm. When this was done the records failed to show any consistent differences between the responses to stimuli at different parts of the alpha cycle, and

# CEREBRAL RESPONSES TO PERIPHERAL NERVE STIMULATION

(FIGS. 1—3)

G. D. Dawson

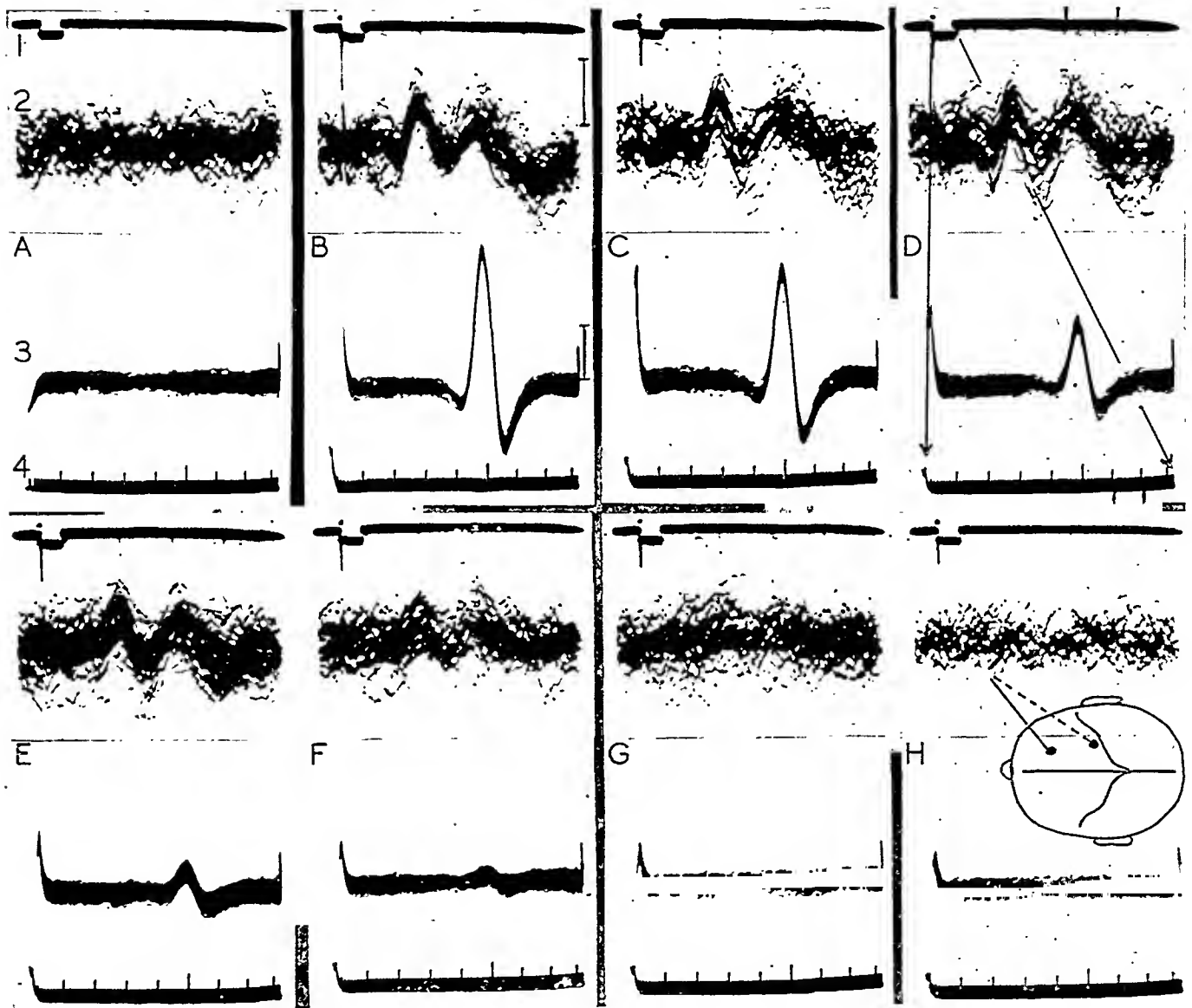


FIG. 1. The 8 records, each of 50 sweeps superimposed, illustrate the relation between the sizes of the action potentials in the median nerve after electrical stimulation at the wrist (trace 3) and the resulting cerebral responses (trace 2). The nerve action potentials were recorded from electrodes on the skin over the nerve above the elbow and the cerebral responses from a pair of electrodes on the scalp 6 cm. apart in the position indicated in H, with the back electrode 8 cm. from the mid-line. The amplifiers were connected in such a way that when the back electrode (dotted line) became positive with respect to the front one (continuous line) an upward deflection was recorded. The stimuli were applied at 1-sec. intervals. The dots above the time-scales indicate the time of stimulation. The short vertical lines in D over trace 1 show 20 msec. for trace 2; those below trace 4 indicate 1 msec. for trace 3. The relative duration and timing of traces 3 and 4 to traces 1 and 2 is shown by the notch in trace 1. The vertical lines after traces 2 and 3 in B show the deflection caused by 10  $\mu$ V. in 2 and 20  $\mu$ V. in 3

In A, no stimulus was applied to the nerve

In B, a stimulus was applied which was maximal for motor fibres

From C to H, the stimulus strength was progressively reduced, being below threshold for motor fibres in D and just above threshold for sensation in H

The records suggest that the greater part of the cerebral response is produced by afferent impulses in fibres with a lower threshold to electrical stimulation than that of motor fibres

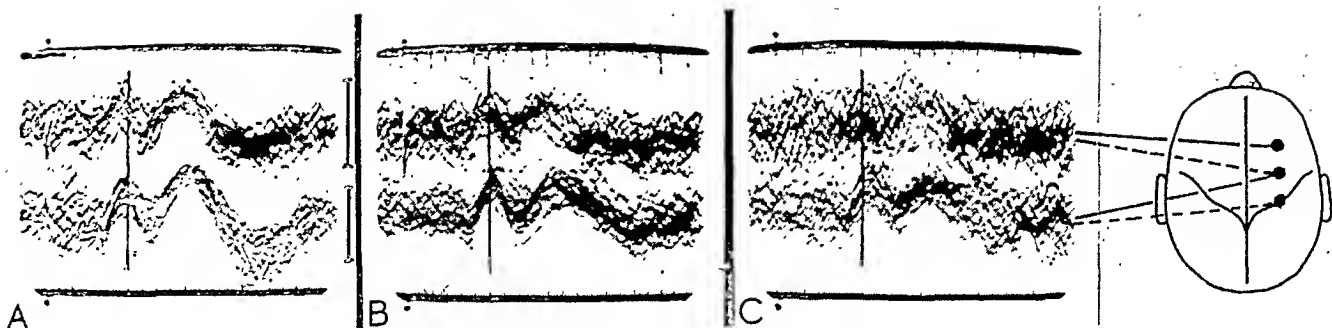


FIG. 2. The 3 records, each of 50 sweeps superimposed, show the cerebral responses to stimulation as follows :

In A, stimulation of the left ulnar nerve at the wrist with a shock just maximal for motor fibres

In B, stimulation of the thumb and fingers with the strongest shock the subject could bear

In C, stimulation of the thumb and fingers with a shock the subject could just detect

The stimuli were applied at 1-sec. intervals. The time-scales show intervals of 1, 5 and 20 msec. and the vertical lines between them show a time-interval of 30 msec. after the stimulus. The dots above and below the time-scales indicate the time of stimulation. The deflection produced by a potential difference of  $10 \mu V$ . at the amplifier input is shown by the vertical lines at the ends of the traces in A. The scalp electrodes were on a line 7 cm. lateral to the mid-line on the right side and were separated from each other by 4 cm., with the back electrode over the surface marking of the central sulcus. The amplifier was connected as described in fig. 1

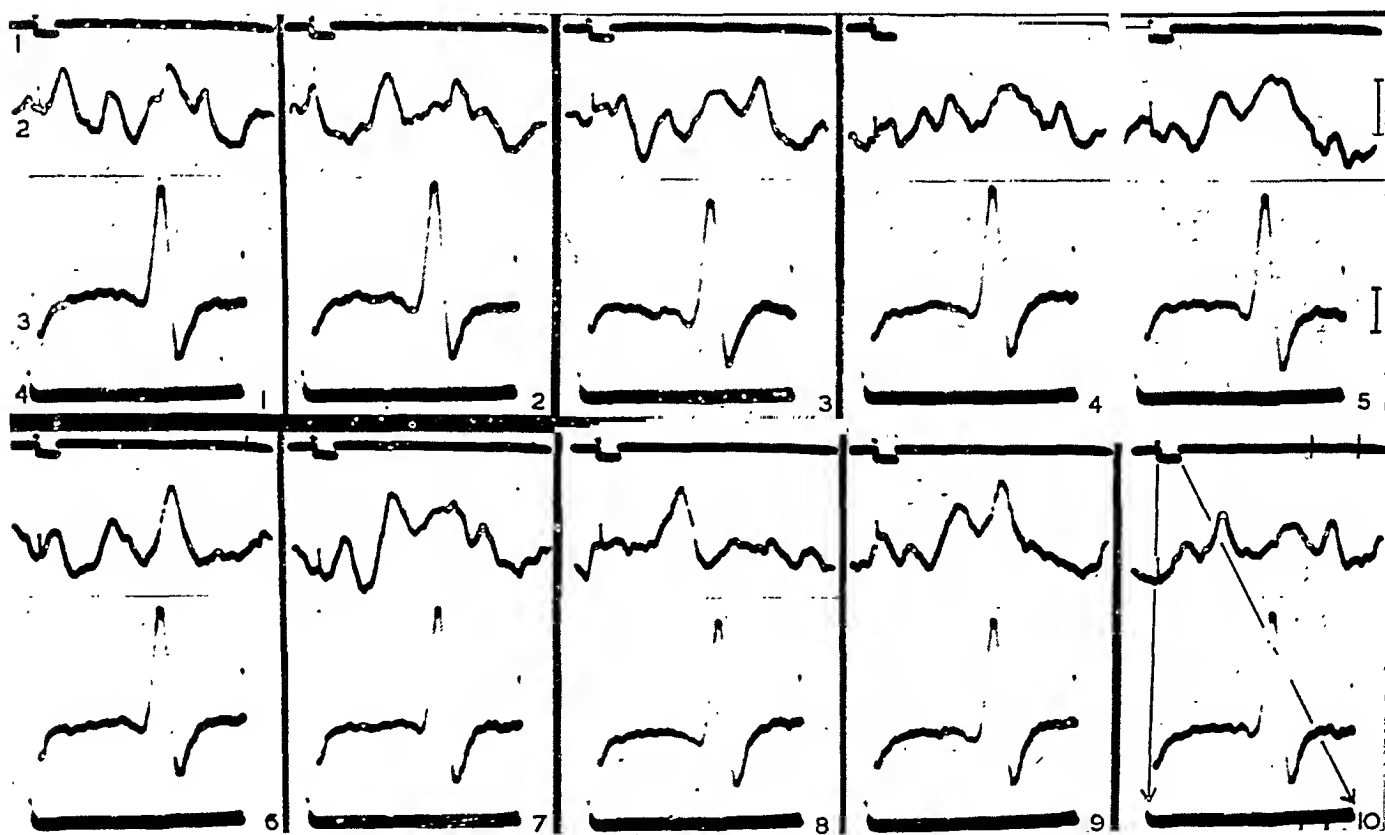


FIG. 3. The 10 records shown were made during the same experiment and under the same conditions as those in fig. 1B, except that they were recorded individually instead of being superimposed. The records show large apparent variations in the cerebral responses in trace 2, without significant alterations in the size of the nerve action potentials in trace 3. The notch in trace 1 indicates the relative timing and duration of traces 3 and 4 to that of traces 1 and 2, as shown in record 10. The short vertical lines above trace 1 and below trace 4 in record 10 show 20 msec. and 1 msec. respectively. The vertical lines at the ends of traces 2 and 3 in record 5 show  $10 \mu V$ . and  $20 \mu V$ . respectively

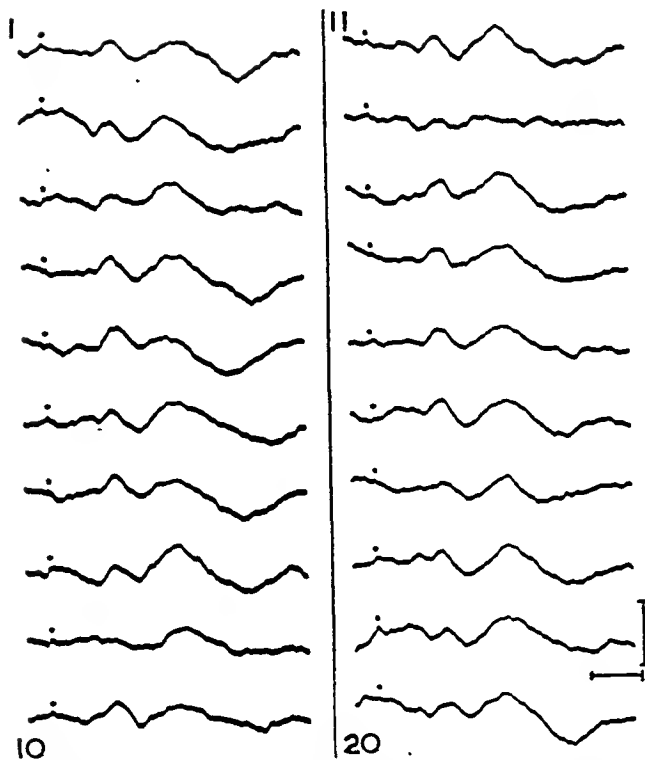


FIG. 4. The records are of 20 consecutive cerebral responses to stimulation of the ulnar nerve. The records were made from a pair of electrodes on the scalp, one over the surface marking of the central sulcus and 7 cm. from the mid-line and the second 4 cm. anterior to it. The cerebral responses are less irregular than those in fig. 3, but they show that either the first or later phases of the response may vary in size or be absent. The vertical line after trace 19 shows 20  $\mu$ V. and the horizontal line below it 20 msec.

the variations between the responses to successive stimuli seemed to be as great as when they were applied at random, or with the eyes open and little or no alpha rhythm present. There was thus no evidence that the cells responding to the afferent volley were occupied at all by cortical activity at the frequency of the alpha rhythm. This finding is of interest in view of the work of Bates (communication to Second International Congress of Electroencephalography, 1949, unpublished) and of Boreham, Kibbler & Richter (1949), who have shown independently, in the first case by a modification of the superimposition technique and in the second case by a statistical examination of measurements from many single records, that the time of initiation of voluntary movements in man

tends to be related to the phase of the alpha rhythm. One explanation of this finding is that a similar relation may exist, in man, between the motor cells and the alpha rhythm mechanism, as Adrian & Moruzzi (1939) showed to exist between the pyramidal discharges and the spontaneous cortical activity in animals. In another sensory field the variations which may occur in both normal and abnormal subjects in the response to visual stimulation with flashes of light, when the rate or phase of the stimulus was altered in relation to the spontaneous rhythms, have been described by Walter & Walter (1949). More recently Cobb (communication to Second International Congress of Electroencephalography, 1949, unpublished) has described in detail regular alterations which have been found to occur in the occipital responses to flash stimuli in conditions of concentration and relaxation of attention. So far no factors which would produce similar repeatable variations in the responses to tactile or proprioceptive stimuli have been found.

## 6. Conclusions

The experiments described suggest that the cerebral responses which may be detected in healthy man, after electrical stimulation of nerve, are probably produced by excitation of at least two kinds of nerve fibre. One type of fibre is that which carries afferent impulses from cutaneous receptors and the other is probably that carrying impulses from proprioceptors in muscle. The records made through skin show that 70 per cent of the nerve action potential which can be detected is due to activity in fibres with a lower threshold than motor fibres; it is the volley in these low-threshold afferent fibres which produces the greater part of the cerebral response. The relative contributions of the cutaneous afferent fibres and of the afferent fibres from muscle to this group of low-threshold fibres is not clear from these experiments. The records of nerve action potentials also indicate that variation in the size of the afferent volley was not the cause of the variations in size of the cerebral responses to successive stimuli of the same kind; no cause for this variation has yet been found but it seems that, even with submaximal stimuli, it is not peripheral. On the other hand the same methods show that, with different types of stimuli, the peripheral differences in the resulting afferent volleys may alone be enough to account for the considerable differences in the cerebral responses produced.

## ACKNOWLEDGEMENTS

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# SENSORY DISCRIMINATION

## With Some Recent Evidence from the Olfactory Organ

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- 1 Identification of the stimulus
  - 2 Visual and auditory stimuli
  - 3 Olfactory discrimination
    - a Recording of impulse discharges in the olfactory tract
    - b Differential analysis of olfactory stimuli
  - 4 Conclusion
- References

The vertebrate nervous system receives its information about the outside world by means of signals transmitted by a large number of sensory nerve fibres. The number must be large, because the range of information which one fibre can transmit is small. The fibre signals the excitation of a sensory ending by transmitting a stream of impulses; the frequency of the impulses shows the intensity of excitation at each moment, but there is nothing else to indicate what sort of change has stimulated the receptor. This limitation comes from the nature of the conduction process in the fibre, for a single nerve fibre is a far less able transmitter of information than a single metallic wire, in which a fluctuating electric current can transmit all the inflections of speech or the pattern of a written message. The nerve fibre can send only brief pulses of activity which depend for their transmission on local stores of energy. They must be all alike and cannot bear the stamp of the event which set them in motion.

Ultimately the afferent messages transmitted in this way will modify the stream of efferent messages which are sent out from the nervous system to the muscles. These, too, are made up of impulses, all of the same form and distinguishable only when the fibres carrying them are of different size. Both on the sensory and motor sides, therefore, a large number of nerve fibres must be available if the efferent pattern is to be effectively harmonized with the afferent, i.e., if the animal is to react appropriately to its surroundings.

During the past 25 years the use of electronic amplifiers has made it possible to record the impulses in single nerve fibres, and we have gained new information about the activities of individual nerve cells and sensory end-organs. This led at first to a focusing of attention on the units rather than on the group, for the technique was more suitable for investigating the performance of the sensory nerve fibre than that of the receptor surface or the motor nucleus. Thus problems involving joint action by many units have had less consideration

than they deserve. But more recently the study of the large-distance receptors and of the sensory areas of the brain has begun to shift the emphasis back from the unit to the group and the purpose of this article is to deal with a general principle which it now seems possible to trace in the organization of the sensory system.

### 1. Identification of the Stimulus

Thinking of the individual nerve fibres, one might have supposed that a sensory surface could be regarded as a patchwork of areas, each of which was supplied by one sensory fibre and by that fibre only. The simplified diagrams in the textbooks of, for example, touch spots did nothing to contradict this impression, but it was soon obvious that it was false. Records of the electrical activity in the frog's cutaneous nerve fibres showed that each supplied an area of several square millimetres and that other fibres had endings in the same area, so that the most strictly localized touch could not avoid exciting endings belonging to a number of different fibres (Adrian, Cattell & Hoagland, 1931). The dispersion is often much greater than this in the mammal, as Weddell's histological studies have shown (Weddell, 1941). One nerve fibre to a rabbit's ear may innervate 300 hairs and each hair may be innervated by many fibres.

The wide dispersion and intermingling of the terminal branches of the sensory fibres means that a touch on the skin will send messages to the spinal cord by many paths. Where these terminate there will be a focus of activity corresponding to the point that is touched and a zone of declining activity round it. Thus the pattern of excitation of the skin will be reproduced more or less faithfully and if one or other of the sensory fibres were put out of action it would not seriously affect the reproduction of the pattern. The information will be supplied both by the spatial and by the temporal pattern of excitation, i.e., by the rate of rise and fall of the impulse frequencies in different fibres. And for recognizing the nature of the object which has touched the skin the temporal element may be the more important. Even if the sensory surface did no more than signal the stimulation of different regions the order in which the stimulation occurred would be significant, and in fact the important sensory surfaces never behave as a static receiving screen. In the intact animal a touch which differs from the expected range of contacts will immediately arouse exploratory movements by which the object can be "felt", as, for instance, when something put in the hand is moved about so that the pattern which is available to the brain is compounded of signals from the tactile receptors and from those which show the movement and position of the fingers. Such qualities as roughness and smoothness, softness and hardness, could be judged only by a combination of spatial and temporal analysis.

Contacts with the body surface are signalled to the sensory receiving area of the brain and we must suppose that the identification of the stimulus is dependent on certain events, some of which must take place in that area. But by the time the pattern arrives there the streams of impulses from the periphery will have lost their identity. They will have travelled the whole length of the sensory fibres, the excitation will have been passed on to other neurones, and wherever the transfer occurs some alteration may have taken place, possibly a sharpening of contrasts and usually a reduction in the number of units involved. Thus the effect of an individual sensory



ending on the final picture becomes even less than on the primary signal: it will not be much greater than that of a single voter in a parliamentary election.

## 2. Visual and Auditory Stimuli

It has been known for many years that an even greater condensation of signals must take place in the eye, for the number of receptors in the retina far exceeds the number of fibres in the optic nerve. But it was not until the impulses in the optic nerve were recorded that it became clear how much interaction could take place between the different pathways. Thus Adrian & Matthews (1928) found evidence of nervous interaction between two points 1 mm. apart on the eel's retina, and Hartline (1935, 1938), Granit (1930) and Granit & Therman (1937) have shown that in frogs and mammals it involves inhibition as well as facilitation. Again, therefore, the contribution of the individual receptor is likely to be submerged in the composite pattern.

With vision, as probably with touch, there are certain parts of the receptor surface where there is less intermingling of pathways. At the macula lutea some of the cones seem to have private pathways through the retina to single fibres in the optic nerve. This may be necessary to give the extreme detail with which the central visual pattern must be reproduced, but the insulation of the pathways from one another is an inference from retinal histology and may turn out to be incomplete.

Both with touch and vision we interpret the stimulus in spatial and temporal terms, and it is therefore not surprising to find the spatial and temporal patterns reproduced in the brain. With hearing, however, there is no spatial quality about the stimulus, yet there is already abundant evidence to show that auditory stimuli are distinguished, like tactile and visual stimuli, by differences in the spatial and temporal excitation pattern. The evidence is partly old and partly new. Helmholtz's resonance theory supposed that the cochlea was so arranged that each part of the basilar membrane would tend to resonate to a particular note. The various objections raised to the theory have now been set aside by the work of Galambos & Davis (1943) on the impulses in the auditory nerve fibres. They find that a pure tone of small intensity excites only a limited region of the basilar membrane—near the basal turn of the cochlea for high tones and near the apex for low. As the intensity of the sound is increased the extent of the excited area enlarges, but the region of maximum excitation remains where it was. Thus the distribution of excitation along the basilar membrane from moment to moment will give all the information needed to specify the sound.

As with tactile and visual signals, the pattern is passed on to the brain, condensed and possibly sharpened, but preserving its spatial arrangement. Tunturi (1944) has found that in the dog the different segments of the basilar membrane are connected with different points in the auditory area, just as the different parts of the body surface are connected with different points in the somatic sensory area. With a high note the cortical activity will be at the front, and with a low note at the rear, and as the sounds change in pitch the region of maximal activity will shift in the basilar membrane and in the auditory area of the brain. There the information is conveyed as before by the temporal as well as by the spatial pattern. A voice will give several peaks of activity, shifting to and fro along the

cortical strip in a characteristic fashion, and our recognition of the voice will depend on the particular sequences which occur.

These results bring hearing into line with vision. In both the eye and the ear the general plan seems to be that a large area closely packed with receptor endings is set in the organ, the structure of which ensures the analysis of the stimulus in spatial terms. The camera arrangement of the eye projects the visual scene on the retina: the resonating system of the cochlea projects different sound frequencies on to different parts of the basilar membrane. It is to be noted also that, in both, the information is transmitted to the brain in the same form, i.e., with the intensity indicated by the impulse frequency and the number of fibres in action. The earlier records from the auditory nerve suggested that the impulse frequency was fixed by the pitch of the sound, but we know now that it varies over the usual wide range and indicates loudness and not pitch.

As in the eye, so in the ear the contribution of any one fibre of the auditory nerve will be relatively unimportant, because even with the feeblest stimulus the message will be carried by a group of nerve fibres. With a loud note, more than half the basilar membrane may be excited. Thus the failure of a few of the receptors would make little difference to the general balance of the pattern. A larger failure might be detected by careful audiometry, just as a scotoma in the field of vision can be detected by careful perimetry, but the subject would be unaware that he was deaf to a particular tone or blind in a particular part of the visual field.

There is, however, one important difference between the signalling of visual and auditory stimuli. So far as we can tell, the most complex sound will be analyzed into a spatial and temporal pattern by the mechanism of the inner ear, but in a complex visual scene there will be differences of colour as well as of light intensity. The analysis of colour undoubtedly depends on the properties of the visual receptors rather than on the optical mechanism of the eye, and if the contours of objects are disclosed to us by the pattern of excitation in the striate area, the same pattern cannot also disclose the colour of the object. There are some grounds for thinking that the colour will affect the temporal pattern, but at present this is little more than a guess.

## 3. Olfactory Discrimination

The eye and the ear are the distance receptors most important to man, but to many animals the nose is the chief guide. In the last few years an attempt has been made in Cambridge to find out how smells are distinguished, and the results, though still very far from complete, point to a fundamental likeness between all three distance receptors (Adrian, 1948). When we consider the olfactory organ, we seem to be confronted with sensory experiences which have no spatial quality and no components like the scale of pure tones which we recognize as building up sounds. But an immense variety of smells can be distinguished and, like the eye and the ear, the olfactory organ has a large sheet of receptor endings and an elaborate structure to contain it.

The receptor sheet is spread out on folded partitions and is exposed to the air in the narrow spaces between them. This air is in free communication with that drawn into the lungs at each breath, for the olfactory organ is set above and behind the main airway through the nose, so that the pressure

gradients will cause some movement of air in the olfactory spaces. The area covered by olfactory receptors is comparable in size to the retina, but the nervous layers of the retina are represented in the olfactory system by the olfactory bulb, which receives the nerve fibres from the receptors. Here synaptic transmission takes place and the signals, greatly condensed, are passed on by the fibres of the olfactory tract in the same way as the signals from the retinal receptors are conveyed by the fibres of the optic nerve.

#### *a. Recording of Impulse Discharges in the Olfactory Tract*

To make clear records of the electrical activity in these fibres the animal must be under anaesthesia deep enough to suppress the spontaneous discharge from cells in the olfactory bulb. It is then found that impulse discharges occur in the tract fibres whenever air containing an odorous substance is drawn through the nose, and we can look for some characteristic difference in the discharges set up by different smells. What has been found is not that there are receptors with specific sensitivity uniformly distributed over the olfactory epithelium—such receptors may exist, though the impulse discharge technique is scarcely precise enough to reveal them—but what is revealed is that with different smells there may be large-scale differences in the level and evolution of the excitation in different parts of the receptor surface. This can be shown by making simultaneous records from different parts of the olfactory bulb. In the rabbit (the most convenient animal to use) an insulated wire electrode thrust deeply into the oral part of the olfactory bulb will record from the fibres which are in touch with receptors in the oral and more accessible part of the olfactory epithelium, and an electrode leading from the aboral part of the bulb will record from fibres in touch with the receptor surface at the back, furthest from the main air current through the nose. It is found that there are two classes of odorous substance which can be clearly distinguished by their relative effect in these two regions. Esters and compounds containing oxygen as well as carbon and hydrogen produce a greater excitation in the front areas, and hydrocarbons and oils generally produce a greater excitation at the back. Either class will stimulate in both regions if the smell is present in high enough concentration; but there is still a characteristic difference in the evolution of the discharge. With the esters it starts abruptly and is very soon over; with the oils it starts more slowly and usually outlasts the period of inspiration. Thus fruity and oily smells could certainly be distinguished by the distinctive spatial and temporal pattern of excitation in the receptor surface.

#### *b. Differential Analysis of Olfactory Stimuli*

On the analogy of the eye and the ear it would seem probable that in the olfactory system the analysis is brought about by the general arrangement of the olfactory organ rather than by a differential sensitivity of the receptors in different parts of it. The general arrangement will certainly lead to considerable differences in the stimulus to the front and back regions. The air current will be more rapid in the more accessible front passages. The air reaching the back will have already passed over much of the epithelium and may have lost some of the odorous molecules on the way. There may be more or less water vapour in the two places, and differences in the fluid covering the receptors. Such differences,

imposed by the structure of the olfactory organ, might well make stimulation by the esters more effective in front and by the oils more effective further back; but it is equally possible that the receptors in the two regions are not exactly alike in their sensitivity to different smells—there is not yet enough evidence to decide. What is clear, however, is that owing to this regional analysis there may be large-scale differences in the pattern of excitation set up by two kinds of smell.

What is not yet clear is the extent to which olfactory discrimination depends on such differences of pattern. They have been shown to exist for only two classes of odorous substance; it does not at all follow that there is a distinctive pattern for every smell that we can recognize. But certainly if there were other differential effects of the same kind, leading for instance to a different distribution of excitation with small and large molecules, the range of analysis would be much greater. And if, in addition, there are some regions where the receptors in general are more readily excited by a particular class of compound, the possibilities are immensely extended. It must be remembered that both the temporal and the spatial distribution of the excitation is probably significant and that the latency of the discharge may vary both with the velocity of the air current (which will differ from one part of the olfactory organ to another) and with the chemical and physical properties of the stimulating molecules. At all events, the evidence as far as it goes supports the view that large-scale differences of pattern can occur, and there has been no indication that the olfactory epithelium is a uniform mosaic of receptors, each with specific affinities for certain kinds of smell. Indeed, if it were, there would be no obvious reason for the large sensitive surface and the complex arrangement of the olfactory organ.

On this view the range of olfactory discrimination will depend partly on the size and complexity of the organ, which has to produce the characteristic pattern for each smell, and also very much on the ability of the central nervous system to discriminate between two olfactory patterns which are nearly alike. If we had the dog's much larger and more elaborate olfactory organ, it would not necessarily follow that we should distinguish many more smells than we do at present; and if the dog had ours he might still have a range of discrimination wider than we have though not as wide as that of a normal dog.

#### 4. Conclusion

It will be seen, then, that from the study of these three kinds of distance receptor organ the same general principle emerges. This is that the signals from them can be recognized or differentiated because the stimulus is analyzed not so much by a large number of receptors of different properties but by the sense organ itself, so that a characteristic pattern of excitation is formed on the receptor surface. The receptors may well differ in range and sensitivity, and the activity of a particular class will assist the recognition of the pattern, but the general balance of activity over the whole surface and the way in which it changes from moment to moment is determined by the structure of the organ in which the receptors are contained. In the eye they are contained in a camera, in the ear they are fixed to a system of tuned resonators, while the olfactory organ seems to act as an analyzer for molecules of different physical and chemical properties. Since recognition

*Continued at foot of page 333*

## LOCALIZATION OF FUNCTION IN THE CEREBRAL [CORTEX

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- 1 Structure of the cortex
  - 2 Motor cortex
  - 3 Physiological neuronography and suppressor areas
  - 4 Cortex and autonomic functions
  - 5 Parietal-temporal fields
  - 6 Levels of consciousness
- References

A man who has the curiosity to look back at the physiological textbooks of about a hundred years ago cannot withhold admiration for the insight shown by the comparative anatomists of that time in deducing the probable uses of the different parts of the central nervous system. They had already firmly chosen the optic thalamus as the chief relay station for sensation, and if they erred in believing that the caudate nucleus and striatum were the chief motor ganglia they were wrong only in calling them "chief". The belated discovery of excitability of the cortex in 1870 (belated because it lagged more than 70 years behind Galvani's discovery of the excitability of peripheral nerve) found the scientific world in a mood of ready acceptance, so well had Hughlings Jackson prepared the way by clinical inference. Once the resistant crust had been broken progress was rapid, especially in the hands of Ferrier, Schäfer and Horsley. Topographical maps of the motor area must indeed have been exciting things to look at for generations who had been taught that the function of the cerebral mantle was to fabricate "the Will", the commands of which were carried out by lower "nervous hands" and principally by the spinal cord. Almost concurrent with the newer exploration of the cortex were the histological researches of Cajal. It was his ability to demonstrate the nerve cell in continuity with its axon and dendrites as a discrete unit that opened the way for intelligent experiment. Before Cajal's time the cortex had appeared to be a meaningless tangle of cells and fibres. So great was the illumination shed by the new histology that Cajal (as Sir Charles Sherrington has said) was the real begetter of the neurone theory commonly ascribed to Waldeyer (1891). The importance of the neurone conception went far beyond that

usually attributed to it, namely that it was a biological unit in which the survival of the axon depended on the cell and vice versa. The importance that others saw in it was that the nervous impulse passed in one direction only, i.e., dromically, so that revelatory experiment became possible by tracing the expected passage of impulses. Brilliant use of this property was made by Sherrington, who painstakingly built up a coherent story of integration in the spinal cord. The relatively simple structure of the cord made this project successful. Sherrington substantiated the claim that Marshall Hall had passionately held (but could not prove) 50 years before—that the spinal cord was an organ and not a large bundle of conducting fibres. By contrast, what we lack still and probably for very long will continue to lack is an equally clear insight into the integration of the brain as a whole.

### 1. Structure of the Cortex

The structure of the cortex naturally attracted many observers. It quickly became apparent that the cortex was not made in a homogeneous and identical pattern but that there were differences almost as one passed from one gyrus to the next. It was thought that these differences must be highly significant and before long several maps of cortical structure, now famous, made their appearance. The best-known maps were those of A. W. Campbell (1905), Grafton Elliot Smith (1907), K. Brodmann (1909), C. & O. Vogt (1919) and von Economo & Koskinas (1925) (for Brodmann's map, see fig. 1). The areal differences depended on cell size, cell shape and density of cell population, and on the position and thickness of interspersed fibre layers. Authority had been given to the view that the chequer-board cortex did in fact represent a pattern of significant functional differences by two discoveries. The unique pattern of the calcarine striate area was found to correspond accurately with the visual area; later O'Leary & Bishop (1938) demonstrated, by stimulating the rabbit's optic nerve and picking up potential-fluctuations in the occipital region, that the electroencephalographic relationships tally very closely with the extent of the anatomical striate area. A further point was that the motor area was found by the Russian biologist Betz (1874) to contain a number of strikingly large pyramidal cells, which caused the part immediately abutting on the fissure of Rolando inhabited by them to be later called "area giganto-pyramidalis". Much more recently it has been shown that the pyramidal tract, tentatively named "Pyramidenstrang" by Türck (1851) when he first ingeniously studied the descending degenerations in the spinal cord, originated from many cells besides the Betz cells (which are, in fact, calculated to contribute not more than 2-3% of the pyramidal fibres) and further that these cells were not, in anthropoids and men at least, the only

### SENSORY DISCRIMINATION

*Continued from page 332*

depends on the general excitation pattern, the interaction and concentration of pathways will not prevent the recognition of the

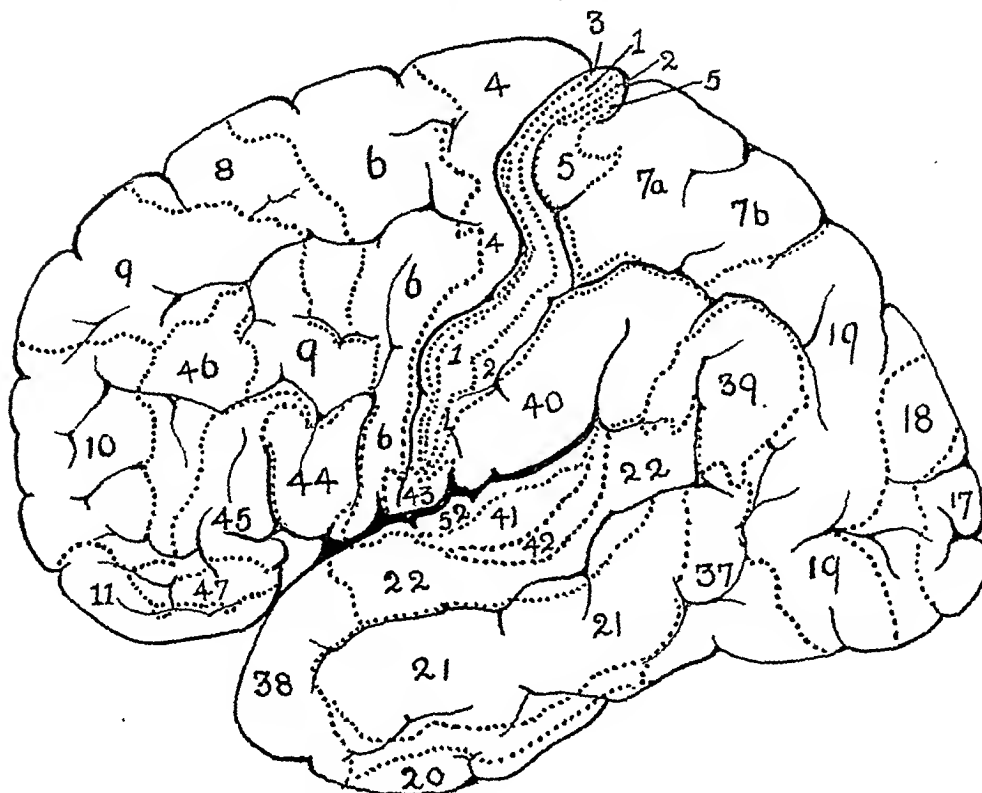
stimulus and, as happens with vision, the interaction may assist it by sharpening contrasts and emphasizing details.

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FIG. 1. BRODMANN'S CORTICAL AREAS, DELIMITED BY HISTOLOGY



ones from which movement could be excited by cortical stimulation. It is not as generally appreciated as it should be that the pyramidal tract was so called not because its fibres originated in pyramidal cells but because it ran through the pyramid of the medulla oblongata. The pyramid had been thought to be the pathway of motor power for generations before its exact location in the cord was discovered by Türck, and even he did not know for certain whence it came. Ignorance of this piece of physiological history can even now lead to confusion.

It gradually became clear that the histologist had provided both physiologist and clinician with more facts about the cortex than they could use. The mind could easily grasp the plan of motor nuclei in brain-stem and spinal cord, whilst the spinal dermatomes and the afferent pathways presented no insuperable obstacles to exploration. But what could be the meaning of the six-layered cortex—this stratification of cell and fibre layers? It had to be admitted that although a single-layered cortex would have been more easy to understand, such a one could surely not have provided an adequate machinery for the limitless variety of human behaviour. Research today is no little concerned with an attack on the meaning of cortical structure, in the hope that it may have a simpler explanation than at present appears. It is possible that parallels may eventually be found in electronic "mock-ups", for certainly scrutiny with the microscope has so far failed to indicate a meaning. Possibly the new quantitative survey of cell population in different areas being undertaken by J. Z. Young at University College, London, may be suggestive. But it may be that the structural differences between various cortical areas are not so great or so important as was once forecast (see Lashley & Clark, 1946). By using micro-electrodes it has been shown that the production of the

potential-pattern of the electroencephalograph seems to be a function of the whole thickness of the cortex and not of any one single layer. It differs, so far as we yet know, not so much in kind as in intensity in different regions.

Perhaps we have been too "cortically minded", have thought too much of, and have searched too readily among, cortical structures during the last decades, to the detriment of our understanding of subcortical and brain-stem mechanisms. Have we not assumed too readily that these last were capable of only the crudest synthesis, and were we not wrong in thinking so? It seems to me that much of the immediate future of neurophysiology will centre on the correlations between the higher and lower levels of Jacksonian integration, and that the lower levels have already won greater respect than they used to have. Changing views about the supreme importance of the cortex might be illustrated by the motor area.

Some of the difficulties that beset the clinician in correlating his bedside observations with the laboratory findings of the neurophysiologist arise from the fact that the latter is much more concerned with, and much more interested in, the cortex of apes, monkeys and the lower animals than he is in man's. The physiologist appears to be more impressed by a chart such as the famous diagram of Grünbaum & Sherrington (1901) of the orang-utang's stimutable cortex than he is by Penfield's topographical charts from 200 human beings (see Penfield & Erickson, 1941). Perhaps I exaggerate if I say that since Penfield's charts are not identical with Grünbaum & Sherrington's in the matter of a separate discrete secondary pre-motor area for eye-turning, then so much the worse for Penfield! But the enquirer must be warned of the differences in outlook between the pure physiologist and the neurologist. Each studies the creatures which most readily lend themselves

to observation—sub-human on the one hand, human on the other. It is difficult to be unbiased in these matters, but it seems to be strikingly true that the clinician is more ready to learn from all sources than is the physiologist, who would do himself no harm by now and again checking his results against roughly comparable results due to disease in man. Much animal experiment is only roughly transferable to man; structures gain in importance as the scale is ascended—compare the crippling effect of total excisions of motor areas in the chimpanzee with similar removals in the cat. But the laboratory worker plays the laboratory game according to the conventions of his fellows and is instructed not to show interest in “applied physiology”, which is for some reason a debased activity (see Fulton, 1949a). But we may properly ask whether “pure” physiology exists and whether it is not always “applied.”

## 2. Motor Cortex

The motor cortex represents movements, fragments greater or smaller of a useful action, rather than muscles (as Walshe, upholding the doctrines of Jackson and Sherrington, has repeatedly said in his scholarly reviews of motor function). Some have thought that refinements in liminal stimulating currents elicited single muscle twitches; and there is no real reason why this should not be so. The suggestion would perhaps seem less shocking if the muscles had never been named and the experimenter saw a twitch in a portion of a complicated muscle mass. Certainly both animal and human behaviour is a matter of co-ordinated movement of large muscle masses, innervated presumably by hundreds or thousands of motor cells.

We are as far off as we were 300 years ago from knowing how the brain uses the motor cortex. The beautiful researches of Sherrington with Graham Brown, and with Leyton<sup>1</sup>, had established finally not only the topographical lay-out of the motor cortex but also its essentially pre-central situation (see Leyton & Sherrington, 1917; Grünbaum & Sherrington, 1901; Brown & Sherrington, 1912). But these researches showed that the motor cortex was not like a pianoforte where pressure on one key invariably produces the same note. It was a somewhat refractory piece of living nervous tissue which *on the whole* gave such and such a result at any given point but which was subject to slight variation—variations that became more apparent the longer the experiment lasted. The anterior edge of the excitable motor cortex seemed to wax and wane, becoming gradually more extended as “facilitation” developed. Every neurosurgeon knows how true this is of the human motor area. Sherrington had shown also that the responses might be reversed, that from a given stimulated spot extension might be replaced by flexion. By varying the parameters of stimulation, more recent explorations have carried knowledge of “reversal” and “deviation” of response much further. Fulton (1949b) has shown that a change of wave shape and intensity of the cortical stimulus alters the motor response in a limb even though the electrode is not moved. Innovations in the kinds of electrical stimuli applied to the cortex are opening up new fields because not only are the motor results different from those obtained by classical faradic methods but silent areas are not so unresponsive as they were to older techniques. This matter has been carried

further by Liddell & Phillips (Festschrift für C. & O. Vogt, in the press) who have obtained by square waves of excitation single ‘flick’ responses in the limbs that vary interestingly in their incidence with the intensity of the stimulus almost regardless of the position of the electrode. The importance of these newer stimulatory methods is that they permit of more intelligible surveys of the motor cortex than were possible in the days when increase in intensity of the faradic current then employed resulted inevitably in a violent epileptic fit that rendered further observation nugatory.

The recently published researches of Denny-Brown & Botterell (1948) bring emendations too, the most important being that partial excisions of Brodmann’s area 4 depress all motor behaviour in the contralateral limbs and that incomplete excisions, although affecting one body segment more severely than another, do in fact depress all the opposite side. This view is supported by Lashley’s observations. Lashley holds that the motor areas are “more concerned with the maintenance of excitability and the regulation of postural reflexes than with the excitation and control of finely integrated movements” (Lashley, 1924). Certainly excitation in man never, in my own experience or in the wider experience of Wilder Penfield, has caused anything more than a fragment of a recognizably useful movement, something that could be imagined as a bit of a skilled movement. But more often the abrupt twitches are no more than caricatures of anything that a man normally does with his limbs. Denny-Brown & Botterell (1948) found that stimulation of the motor cortex abutting on the central sulcus evoked more localized effects in distal joints than were obtained from stimulation of the anterior parts of that area, which seemed to be more concerned with postural movements of the proximal joints. The highest digital skills were most posterior. But the whole function of area 4 was less specific than has been so far taught. Spasticity developed after all excisions of the motor area. This vindicates the claims put forward by Walshe in several papers (Walshe, 1944, 1947), for he was unable to reconcile clinical observation with certain experimental findings of Fulton. The permanent flaccidity reported by Fulton & Kennard (1934) after excision of area 4, and spasticity after excision of area 6, was not confirmed by Denny-Brown & Botterell (1948). The flaccidity said by Tower (1944) to result from section of the pyramids remains for the moment a mystery. Flaccidity does actually occur for a time after complete motor excisions but Denny-Brown & Botterell (1948) attribute it to “pyramidal shock”, which does not persist indefinitely. It is prevented or shortened in duration if parcels of Betz cells are left behind during the excisions. Spasticity is held to be a disorder of the intimately associated neurones connecting the motor area to the mesencephalic and bulbar (tectal) mechanisms. It is this disturbance which induces the most characteristic features of hemiplegic spasticity. Denny-Brown & Botterell (1948) conclude that “. . . area 4 acts as a potentiator and integrator of movement more directly related to the thalamus and the pontospinal mechanism than to the remainder of the cortex.” When we read this conclusion we may recall Hughlings Jackson’s cautious belief that certain convolutions are only *more* concerned with movement than others—the monopoly was not absolute. And experiments clearly show that far more movements are obtainable from the motor area than elsewhere, but in some circumstances movements have in fact been evoked from most of the

<sup>1</sup> A. S. F. Leyton was earlier known as Grünbaum; earlier publications therefore appeared under the latter name.—Ed.

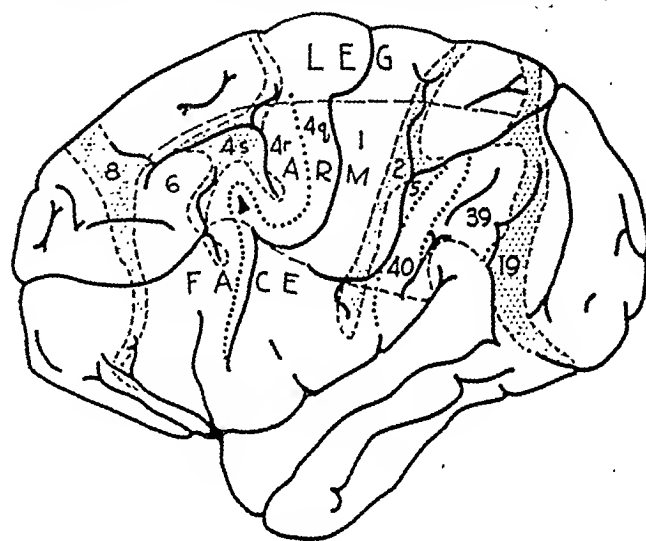


convolutions (see the work of Penfield, Dusser de Barenne, and others). Area 4 in man is said by Lassek (1948) to contain about 34,000 Betz cells; these are more numerous at the mesial end of the motor area, i.e., the leg area. The significance of this particular distribution is puzzling. In numerical contrast the pyramidal tract at the level of the medullary pyramid contains roughly 1 million fibres, of which some 40 % are non-medullated, and great numbers are very fine indeed. The number of large fibres such as would furnish a fast-conducting system is roughly the same as the number of cortical Betz cells. The origin and purpose of the slow-conducting fine fibres are not known; some may be autonomic. But it is quite certain that the pyramidal tract must contain great numbers of fibres from sources other than the Betz cells. At the moment all available evidence (e.g., cord degeneration studies after decortication in animals and after hemispherectomy in man) indicates that all the pyramidal fibres spring from the cortex. The histological sections of the cord after cortical excisions (Leyton & Sherrington, 1917) showed fewer degenerated axons than would have been expected and moreover that they were scattered in a random fashion in the tract. There seems to be no authority for Foerster's diagram (1927) of a neatly laminated pyramidal tract, with the short distance axons nearest the central grey matter for convenience of access. It was a pretty picture, but it was a piece of artistic imagination—but then Foerster was a highly imaginative man.

### 3. Physiological Neuronography and Suppressor Areas

The discovery by Dusser de Barenne that a piece of filter paper 3–4 mm. square soaked in a saturated solution of strychnine sulphate was a powerful and long-lasting stimulator of cell bodies, but not of axons, provided the experimental physiologist with a new laboratory tool (Dusser de Barenne, 1933). In fact the discovery of different kinds of both electrical and of chemical stimulation has caused some formerly "silent" areas to yield information. The results of strychnine stimulations such as these could be used in two ways. It could be a method of direct observation, such as by application to an animal's cortical sensory area in topographical sequence, with watch kept on the body segment in which the stimulatory effects (usually unpleasant) were evidently experienced. Or it could be used in combination with electronic pick-ups to discover the interrelationships of cortical areas. By this means many of the fibre connexions known by anatomical dissection were discovered to be what they seemed—bundles of functional association or perhaps inter-cortical projection fibres. It has proved its importance by verifying the direction in which the nervous impulses passed, a fact on which pure dissection could pronounce no judgement. It has been possible to do a good deal more than that by quickly identifying the relationships between cortex and thalamus and hypothalamus. In the main it verifies the painstaking and beautiful experimental anatomical studies of Le Gros Clark and of Earl Walker (see, for example, Le Gros Clark, 1932a, 1932b; Walker, 1938). This work lies along the lines already mentioned, a retreat from the study of areal differences in the cortex to that of cortical linkages with deeper structures. But the other point just mentioned stands out very clearly: the previously "silent" areas are now stimutable and the effects of stimulation can be picked up by electronic recorders.

FIG. 2. McCULLOCH'S MAP OF SUPPRESSOR STRIPS AND HIS ANALYSIS OF CORTICAL INTER-RELATIONS



ce											
8	6	4s	4r	4q	1	2	5	40	39	19	
YA	—	—	—	—	—	—	—	—	—	—	—
Y	YA	Y	Y	Y	Y	·	Y	—	Y	—	—
—	—	YA	—	—	—	—	—	—	—	—	—
—	—	Y	YA	Y	—	—	—	—	Y	—	—
1	—	—	—	YA	Y	—	Y	—	—	—	—
—	—	Y	Y	Y	YA	·	Y	—	Y	—	—
—	—	—	—	—	—	YA	—	—	—	—	—
—	—	—	—	—	Y	Y	·Y	YA	—	Y	—
—	—	Y	—	—	Y	—	·Y	YA	—	—	—
—	—	—	—	—	—	—	—	·Y	YA	Y	—
—	—	—	—	—	—	—	—	—	—	YA	Y

By courtesy of Dr McCulloch

Map indicates areas of sensory and adjacent cortex, distinguishable by physiological neuronography, in chimpanzee (*Pan sotyris*). Below are diagrams indicating maximal axonal field disclosed by repeated strychninizations in area marked  $\Delta$ . Horizontal dashes indicate suppression of electrical activity; Y indicates area fired; ce refers to central sulcus; double vertical lines indicate anterior and posterior borders of sensory cortex. (Reproduction of fig. 91b, in *The precentral motor cortex*. See McCulloch, 1944.)

Amongst the most interesting and unexpected of these results has been the discovery by Dusser de Barenne & McCulloch (1934) of suppressor areas, work extended by those observers, by Bailey and by Garol. Four suppressor strips are now known, two frontal and two parietal (see fig. 2), making five in all, including Brodmann's area 24 discussed below. Strychninization of these strips leads to the extinction of spontaneous electrical rhythms in the cortex and renders the motor area silent to stimulation; tendon reflexes may be temporarily abolished. The effects may not come about for 20 minutes and may last as long or longer. Garol & Bucy (1944) found that stimulation of strip 4S leads to motor relaxation in the contralateral limbs in man. The part played by

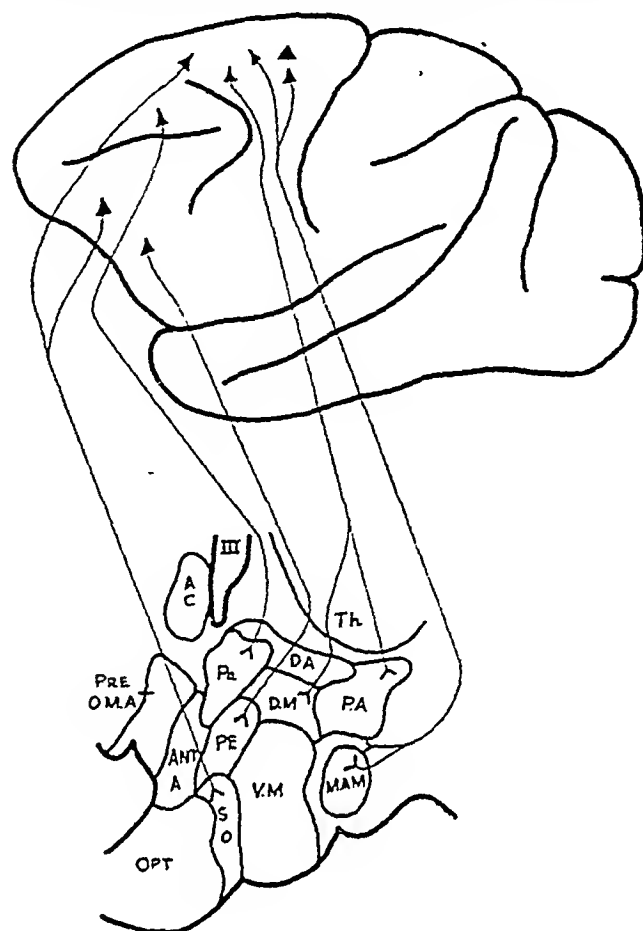
these contributory cortical areas in the normal synthesis of behaviour is neither known nor easily foreseen. Probably nothing exactly like the suppression that can be obtained experimentally actually occurs in health. But it is well enough known that brain activities must be a balance of activation and inhibitions. It is presumed that the suppressor strips must be part of the inhibitory system. Each suppressor area is associated with a major functional subdivision of the cortex (see fig. 2): area 8 with the associative activity of the frontal pole, area 4S with motor control, suppressor area 2 with sensation, and area 19 with vision. McCulloch (1944) has shown that all have connexions with the caudate nucleus and some parts of the corpus striatum, and these structures are supposed to block thalamic impulses from reaching the cortex. Ritchie Russell (1947) has suggested that cortical injuries that coincide with these strips are more likely to produce fits than those in other parts of the cortex.

#### 4. Cortex and Autonomic Functions

Another important suppressor area appears to be Brodmann's area 24 or the cingulate gyrus. Long considered to be part of the rhinencephalon and olfactory system, Le Gros Clark (1948) and von Economo & Koskinas (1925) see in it a highly important vegetative centre. Pupillary dilatation, pilo-erection, vagal slowing of the heart, and respiratory slowing and arrest for as long as 25 sec. have been observed on stimulation of different parts of the cingulate gyrus. It appears also to be a secondary motor area, since tonic bilateral movements of the limbs have also been observed to follow stimulation. Strychninization causes widespread and deep suppression of electrical activity in the rest of the cortex, a suppression mediated, according to McCulloch (1944), by the caudate nucleus. Ablation of the cingulate gyrus leads to considerable change in personality in monkeys—disappearance of shyness and hostility, and a concomitant lack of social sense so that the monkey will walk on its fellows or take food from them without expecting reprisals. How far any of these functions are applicable to man is not known but probably its dominance in all directions is less pronounced than in the macaque. Confirmation, however, is required.

Another important autonomic area lies on the orbital surface of the frontal lobe, lateral to the olfactory tract but close to its lateral root. This is Brodmann's area 13. Stimulation of this area was found long ago by W. G. Spencer (1894) to lead to respiratory arrest. Lately this area has been much studied by Bailey & Sweet (1940), and by Livingston *et al.* (1948). Stimulation of a corresponding area (which is perhaps area 47) has been observed to lead to respiratory arrest and a slow moderate rise in blood-pressure. Strychninization of this area has been shown to cause firing of certain of the hypothalamic nuclei, paraventricular and posterior (Warren McCulloch, Bailey and Ward) (see fig. 3). Another interesting observation has been that prolonged faradization of this area in the cat caused ischaemia of the renal cortex with a shunt of blood-flow similar to that discovered by Trueta *et al.* (1947) at Oxford. Vasodilatation of the extremities generally followed excision of these areas in monkeys but also rendered them restless and over-active (Livingston *et al.* 1948). Autonomic reactions such as pilo-erection were recorded by Fulton and his co-workers from the motor area or its immediate environs. Connexions with the hypothalamus are probably weakly and thinly sown in the cortex; the

FIG. 3. McCULLOCH'S DIAGRAM OF REVERBERATIONS IN HYPOTHALAMIC NUCLEI FROM STIMULATION OF THE ORBITAL FRONTAL CORTEX



By courtesy of Dr McCulloch

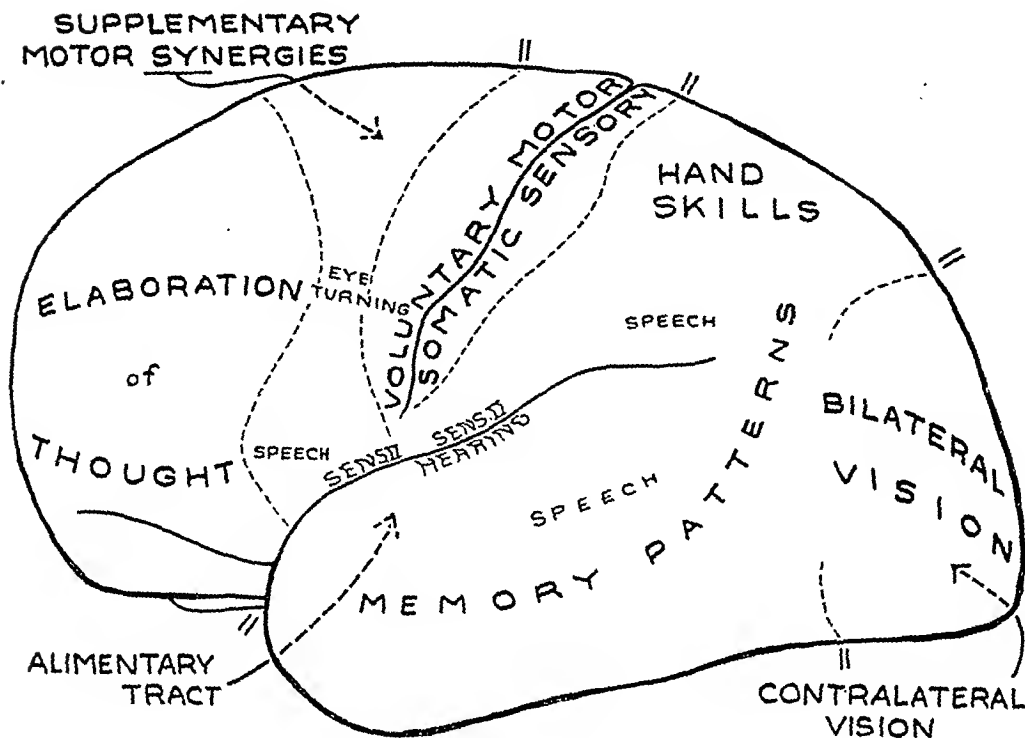
main concentrations so far found have been those mentioned on the orbital surfaces and in the cingulate gyrus. Bucy & Pribram (1943) have recorded a case of localized sweating from a glioma affecting area 44.

#### 5. Parietal-Temporal Fields

It has been said that the anatomist of 40 years ago had high hopes that clinician and neuropathologist between them would be able to substantiate the functional individuality of a great number of histologically different areas. Electrical stimulation of the brain in animals and later in man, although it gave fascinating results, accounted when all was said and done for a surprisingly small portion of the total cortical area. Vast tracts remained which were silent to stimulation. It was in these regions that the clinician might hopefully be expected to discover a coherent description of function from human beings able to give an account of their subjective experiences. This proved to be true of certain regions, notably those concerned with language and sensation.

An example already existed from pre-stimulation days, namely, Broca's use of Dax's discovery that dysphasia required usually a left-sided lesion. Broca selected the posterior end of the third left frontal convolution as the area

FIG. 4. LOCALIZATION OF FUNCTION



By courtesy of Prof. Wilder Penfield

concerned with language. He chose this because Dax had shown that the lesion producing dysphasia must be left-sided; Broca chose the third frontal convolution because this lay nearest to the orbital surface of the frontal lobe, i.e., nearest to the area in which his passionate and vituperative senior colleague Bouillaud said that speech lay (on both sides); and he chose the posterior part because that area was softened in his famous case "Tan Tan". But in "Tan Tan" there was also softening in the whole middle cerebral territory, including the upper and middle temporal, pre-central and post-central, and lower parietal convolutions, as Souques (1928) pointed out. It is not surprising that every kind of observation has failed to discover the real relationship of Broca's area to speech or even to certify with finality what part in speech the cortex of that area plays. It is quite clear that Broca's area was originally taken much too seriously; Broca's own observations were trivial. It is little more than the oddest of chances that the third left frontal convolution has anything to do with language. Broca knew nothing of its proximity to the not yet discovered face-head motor area.

Despite the labours of Sir Henry Head, Pierre Marie, Henschen, Wernicke, and others it cannot be said that we are much nearer an understanding of the physiological and cortical anatomical substratum of speech than we were many years ago. Stimulation of Broca's area in man may cause movements of the larynx and Penfield often produced crude vocalization without words by stimulation in the cortical head area, i.e., roughly in the posterior end of Broca's area. Stimulation in the pre-central area, but especially in the superior temporal and angular gyri, may lead to arrest of speech (Jefferson, 1935; Robb, 1948). Penfield's and my own excisions of Broca's area, with care to avoid deep under-

cuts in the white matter, have led at most to nothing more than transient aphasia.

The means by which our wordless sensa are turned into speech completely eludes us. Some, like myself, feel sure that the precursors of speech must surely be present in species lower than man; there are broad hints of this in anthropoids. It seems that an entirely new approach is required if we are to advance further. So far a new way has not been found. We are left with the belief that destruction of the angular gyrus leads to much more profound disturbances of ideation and language than do lesions elsewhere, and that they wreck mental processes more subtly than do severe frontal lesions. But physiology has as yet no new clarification of the underlying mechanisms to offer.

On the other hand, the somatotopic plan of the human post-central sensory area has advanced far since the first stimulation under local anaesthesia by van Valkenburg (1914) and by Cushing (1909). Thermionic recording from the post-central gyrus of animals (Bard, 1938) when sensory stimuli were applied to body and limbs has brought information of that area in these animals almost up to the level of our knowledge of it in man. It is interesting to note that local injections of strychnine into parts of the optic thalamus cause pain and paraesthesia in the animal very suggestive of Déjerine & Roussy's thalamic syndrome (1906). A more important discovery, unparalleled in the laboratory, has been the illuminating demonstration of the linkage between spatial orientation and the parietal cortex of both sides. A number of first-rate observations have been made on this type of agnosia by Holmes, Riddoch, Russell Brain, Critchley and Purdon Martin. The latter in particular has considered that man's spatial orientation depends on the lower parietal field.

Lesions in the parietal area have been shown to produce not only a loss of the power to find one's way about, even in the familiar purlieu of one's own house, but a loss of power to conceive space in even two dimensions. It becomes impossible to draw a plan of a house; for instance, the kitchen may be depicted as a separate disconnected object in the garden. The same lack of orientation holds for dressing if the plan of articles of clothing can no longer be perceived. Concurrently may be seen a loss of recognition of half the body as a personal property, as Purdon Martin (1949) illustrated. It is in such ways as these, as in the visual field analysis of occipital lesions, that the clinician has made contributions that could not have come either from experiments on animals or from purely histological studies. The map of cerebral function recently devised by Penfield (fig. 4) lacks reference to man's recognition of his personal orientation but otherwise is interesting.

### 6. Levels of Consciousness

The concept, that awareness of surroundings is a primitive defence mechanism in a wide biological sense and has a brain-stem location rather than a purely cortical one, was put forward by the present writer (Jefferson, 1943) in relation to concussion. This was not a complete innovation because Fulton and Bailey, J. C. White, and Penfield had produced evidence of extinction of consciousness by lesions in the region of the third ventricle. Cairns *et al.* (1941) had also described a state of "akinetic mutism" in a girl with a congenital pituitary cyst. None the less the notion of low-level location for consciousness seemed to shock the too "cortically minded". Clinical observation has, however, done nothing but confirm the view and it is doubtful indeed whether any cortical lesion can cause unconsciousness except by driving down to at least thalamic levels, as Penfield and Jasper have contended. Again, no one who has watched a clot in the posterior fossa causing a patient to go through exactly the same stages of increasing stupor as that caused by middle meningeal bleeding can fail to be impressed by the sensitivity of the brain-stem. This sensitivity shows itself not so much by alteration in the medullary vasomotor centre and respiratory centres but in extinction of consciousness, and that with normal or atmospheric pressure in the ventricles (Jefferson & Johnson, in press). The relevant area seems to be the upper pons and lower mid-brain, presumably by some suppression of afferents or effect on the upper brain-stem. In going to sleep, alterations in electrical rhythms are first seen in the thalamus and below, last of all in the cortex.

Bound up with these functions must be the integrative action of the thalamic reticular system and its relations with the brain-stem reticular systems recently disclosed by Jasper (1949). It is well known that cortical responses can be picked up in very circumscribed areas on stimulation of the dorso-medial nucleus of the thalamus, thus verifying physiologically

the connecting fibres discovered by Le Gros Clark by anatomical methods of research. Exploration of the thalamus by stimulation along a fine insulated needle reveals a circumscribed point (which can be reached from several directions with the same result) at which control of the normal symmetrical cortical rhythms can be achieved. This area appears to be in the inter-laminar thalamic areas. It was known that the thalamus had a rhythm of its own of 8–12 per sec. waves, similar to the cortex, and some had thought that it was these thalamic rhythms which drove the cortex. Jasper, and Denis Williams working independently, did not accept this view; Williams' recent thalamograms confirm his belief (see Williams & Parsons-Smith, 1949). Jasper's experiments proved that the waves and, equally, bursts of activity, are not exactly synchronous in thalamus and cortex, though they could sometimes be in step. Stimulation of the thalamic reticular system caused a sudden stop of responsiveness in the freely moving conscious animal, suggesting an arrest of awareness as in petit mal. Powerful stimulation in the thalamus would cause a generalized fit. The important point is that stimulation of the thalamic reticular system had a wide-spread general effect on the animal's behaviour without affecting postural reflexes. After-discharge with slow spike and wave form was common. Magoun and his colleagues have brought forward evidence of the relationship between the reticular portion of the brain-stem and cerebral activity. Jasper (1949) concludes that there is in the thalamus a regulating mechanism "involving thalamic and other brain stem structures . . . controlling the form and rhythm of the background of cortical activity upon which afferent impulses must act, and regulating local and generalized excitatory states of the cortex as a whole." He believes that the thalamic reticular system is the most important item in these mechanisms. Whether these integrative actions will be confirmed by other writers and especially by thalamic stimulation in man remains to be seen.

These remarks on subcortical functions and their possible relationships to cortical control have been inserted in proof of something said in earlier passages: that we are in process of searching for some general scheme, however vague and uncertain its details might be, of the general plan of integration of the brain as an acting whole. My purpose has also been to show that the modern exploration of the cortex is deeply concerned with the physiological connexions of cortical areas to deeper structures. The search will be carried on in a vertical direction rather than on the plane surfaces of the cortical cartographers of 40 years ago. I do not intend to suggest that the cortical areas for long so well known are unimportant but that the integration is carried out not only by inter-cortical connexions but also by a multitude of "feed-backs" to the deeper structures of the brain, and that the physiological state of the cortex depends on the state of subcortical structures.

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## ANATOMICAL RELATIONSHIPS BETWEEN THE CEREBRAL CORTEX AND THE HYPOTHALAMUS

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- 1 Afferent hypothalamo-cortical connexions
    - a* Anterior nucleus
    - b* Dorsomedial nucleus
  - 2 Efferent cortico-hypothalamic connexions
    - a* Fronto-hypothalamic connexions
    - b* Connexions between frontal cortex and mamillary body
    - c* Limbic cortex and hippocampus
  - 3 Conclusion
- References

If the comparative anatomist were asked which parts of the cerebrum are to be regarded as the most primitive and archaic and which the most advanced and recently acquired (in the evolutionary sense), he would point to the hypothalamus and to the neopallial component of the cerebral cortex, respectively. The hypothalamus comprises a relatively well-developed part of the forebrain in all vertebrates, from the lowest to the highest and, indeed, shows but little change in its nuclear content and differentiation throughout an extensive comparative series which includes every level of mammalian development and even some of the submammalian vertebrates. The neopallial cortex, however, is commonly believed to have no representation in submammalian vertebrates, and, as is well recognized, undergoes a progressive elaboration in the evolutionary scale of the mammals until, in man, it achieves the acme of its development. This broad contrast, so apparent in comparative anatomical studies, is equally well reflected in physiological studies. On the one hand, the hypothalamus has been demonstrated to contain neural mechanisms intimately concerned with the regulation of autonomic functions and basic metabolic activities. On the other, the cortex provides the basis for such highly integrated functions as those concerned with sensory discrimination and the voluntary control of movement. It has, of course, been long accepted that these contrasting aspects of cerebral function are by no means wholly independent of each other. But it is probably fair to say that for many years neurologists have tended to assume that, within the organization of the cerebrum as a whole, these functions have become segregated to the extent that functional interrelationships between them occur predominantly at lower levels.

Undoubtedly one of the outstanding features of the study of brain functions during recent years is the demonstration

that the interaction of cortical and hypothalamic functions is much more direct than had been supposed. For example, impulses from important centres in the hypothalamus can be directly projected, through monosynaptic relays, to specific areas of the cortex, while electrical stimulation of these specific areas of the cortex can be shown to affect autonomic activities through the medium of the hypothalamus. Apart, however, from the evidence of specific relationships between hypothalamic nuclei and cortical areas, there is also evidence that the hypothalamus may profoundly influence the activity of the cortex as a whole. Thus the spontaneous rhythmic electrical activity of widespread areas of the cerebral cortex may be modified or abolished by appropriate lesions in the hypothalamus (Obrador, 1943), while electrical stimulation of the hypothalamus may accentuate cortical potentials (Grinker & Serota, 1938). It now appears certain that the hypothalamus influences the cerebral cortex through the intermediary of certain principal nuclei of the thalamus which project on to focal areas of the cortex. In recent years it has also been shown that other elements of the thalamus, represented by the intralaminar and mid-line nuclei, have a diffuse projection by means of which the rhythmic activity of extensive areas of the cortex may be controlled and integrated; this raises the interesting question whether these elements may perhaps also serve to relay hypothalamic impulses of a more generalized type.

In any case, it is clearly a matter of some importance to determine to what extent cortical functions, whether expressed in focal responses or in total patterns of rhythmic activity, may be ultimately determined, or at least influenced, by activation from primarily hypothalamic sources, and it is partly for this reason that more and more attention has been focused in recent years on the precise details of cortico-hypothalamic fibre connexions. In this short review, we are concerned to give a précis of our present knowledge of these connexions and to indicate the methods which may be used to elucidate them in still further detail.

### 1. Afferent Hypothalamo-Cortical Connexions

Apart from the possibility of diffuse and indirect ascending connexions, through which impulses from the hypothalamus may eventually be relayed to the neopallial cortex, there are now known to be two main relay centres in the thalamus whereby such impulses are focused directly on to specific cortical areas. These centres are the anterior nucleus and the dorsomedial nucleus.

#### *a. Anterior Nucleus*

The anterior nucleus of the thalamus in lower mammals can be readily subdivided into three quite distinct elements, the anterodorsal, anteroventral and anteromedial nuclei, and the earlier evidence that these three elements project on to specifically different areas of the so-called limbic cortex has now been confirmed in considerable detail by Rose & Woolsey (1948). In the higher primates, including man, the anteromedial element has undergone retrogression, and the main element is the anteroventral. This well-defined group of cells is sufficiently large in the human brain to form a conspicuous eminence—the “anterior tubercle”—on the upper surface of the thalamus, which every student sees for himself when he first dissects a brain.

The anteromedial element of the anterior nucleus is connected with the anterior limbic region (area 24),<sup>1</sup> the antero-ventral element sends its fibres to the posterior limbic region, at least mainly to area 23, while the smaller anterodorsal element projects still further back to the retrosplenial region of the cortex. In the human brain the main element of the anterior nucleus probably sends some fibres to area 24 (as well as to area 23), and it may be, therefore, that it represents a mergence of the anteroventral nucleus with remnants of the anteromedial element of lower mammals. Since the anterior nucleus of the thalamus is known to receive its afferent impulses by way of the mamillo-thalamic tract (bundle of Vicq D'Azyr) which, again, takes origin from the mamillary body (mainly the medial mamillary nucleus), it evidently serves as a simple relay whereby the mamillary component of the hypothalamus acquires a cortical representation. The significance of this very well-defined projection system is by no means certain. For many years it has been ignored and forgotten, on the assumption that it was an unimportant relic of the "rhinencephalon". Until quite recently, indeed, standard textbooks have mistakenly included the whole of the limbic cortex, as well as the mamillary body, the bundle of Vicq D'Azyr and the anterior thalamic nucleus, in the "rhinencephalon". It is clear that the term "rhinencephalon" has led to very serious misconceptions, and it should now be redefined. The reason for attributing olfactory functions to this system was simply that the mamillary body is the terminal station of the fornix system which has its main origin in the hippocampus, and the latter had come to be regarded as "olfactory cortex". In recent years, however, increasing doubt has been thrown on this traditional conception, and the critical review by Brodal (1947), as well as the more precise definition of the olfactory pathways and centres in the rabbit (Le Gros Clark & M. Meyer, 1947) and monkey (M. Meyer & Allison, 1949), has made it clear that this view can no longer be seriously maintained.

This being so, it now becomes a matter of the greatest importance to elucidate the real functional significance of the hippocampus. Unfortunately, little is known of the details of its afferent connexions, except that at least the majority of them come from the posterior piriform cortex and from the cortex of the limbic region (either directly or by way of the cingulum). This latter connexion provides anatomical evidence for the supposition that the hippocampus and the fornix system form part of a circuit which perhaps maintains a continuous cycle of functional relationship between the hypothalamus and the neopallial cortex. This circuit, it seems, would be made up as follows: hippocampus→fornix→mamillary body→anterior nucleus→limbic cortex→cingulum→hippocampus. It is by no means, however, a closed circuit. For example, although the mamillary body is mainly served in its afferent connexions by the fornix and hippocampus, its cells may also be influenced through ascending fibres which are present in the mamillary peduncle (Ibañez, 1938) and probably have their origin in the ventral tegmental nucleus of the midbrain (Fox, 1941); in addition the cells are almost certainly influenced by impulses from adjacent parts of the hypothalamus, and also by corticofugal fibres derived (at least in part) from area 6 of the frontal lobe (*vide infra*). Again, impulses from the

anterior nucleus of the thalamus which arrive at the limbic cortex may presumably be influenced there by the activity of other areas of the cortex. Nevertheless, the circuit appears to be exceedingly well defined anatomically and it is all the more remarkable, therefore, that its function should still remain so obscure. Possibly it plays a part in maintaining neopallial activity (either by activation or inhibition) at a level necessary for the manifestation of normal cortical functions during waking life. In this connexion, it is worth bearing in mind that the cingulate gyrus of the limbic cortex forms one of the "suppressor areas" and, like all the other suppressor areas of the cerebral cortex, pours efferent association fibres into the mysterious area 32 which A. Meyer & McLardy (1949) have referred to as a nodal point of considerable physiological activity between cortex and sub-cortical basal ganglia. That it has some concern with cortical activities underlying rather complex psychological processes is suggested by the few observations which have so far been made on the clinical effects of interference with some parts of the circuit (see, for example, Grünthal's report of a case with circumscribed destruction of the corpora mamillaria, 1939). On the other hand, so far as physiological responses of a simple type are concerned, experimental investigations involving the circuit in animals have so far led to little result, apart from the fact that stimulation of the anterior limbic area has been shown to lead to autonomic and motor phenomena (Smith, 1945; Ward, 1948). Sigrist (1945), who made a careful study in Hess's laboratory of the effect of stimulation of the mamillo-thalamic tract in the cat, was forced to conclude that there is no definite physiological response which can be related to it ("... derselbe muss daher für den Tierversuch als 'stumme Zone' angesehen werden").

It is of some interest to note that the hippocampal circuit referred to above is characteristic of the mammalian brain; it appears to have no representation in the reptilian brain. Thus, in spite of statements which have sometimes been made to the contrary, there is nothing in the reptilian brain which corresponds to the medial mamillary nucleus, the mamillo-thalamic tract, or the anterior nucleus of the thalamus (see Ariëns Kappers' study of the mammalian homologues of the dorsal thalamic nuclei of reptiles, 1942). It follows that the functions subserved by the circuit must have a relation to forms of cerebral activity which are not to be found in any vertebrates other than mammals. In other words, it is hardly likely to be concerned with physiological responses of an elementary character.

#### *b. Dorsomedial Nucleus*

We may now briefly refer to the other main element of the thalamus concerned with the relay to the neopallial cortex of impulses originating in the hypothalamus, viz., the dorsomedial nucleus (medial nucleus of human anatomical terminology). The fact that this nucleus projects mainly on to the granular areas of the frontal lobe has now been amply confirmed by many investigators, and the relation of different sectors of the nucleus to specific cortical areas has been studied in great detail in leucotomized human brains by A. Meyer, Beck & McLardy (1947). These authors have shown, *inter alia*, that the medial portion of the dorsomedial nucleus (which is in most immediate relation to the periventricular system of fibres in the wall of the third ventricle) projects on to the orbital cortex, while the main lateral part sends fibres

<sup>1</sup> Except where otherwise stated, the numbers refer to the areas of the cortex in Brodmann's notation (cf. fig. 1 in article by Jefferson, p. 334).—Ed.

to areas on the convexity of the frontal lobe. That these fibre connexions with the cortex serve to relay hypothalamic impulses was initially inferred from anatomical evidence (not entirely satisfactory) that the hypothalamus is linked with the dorsomedial nucleus by the periventricular system of fibres which ascend close to the wall of the third ventricle. This has now received confirmation from the electro-physiological studies of Murphy & Gellhorn (1945), who were able to demonstrate characteristic changes in electrical potentials in the dorsomedial nucleus following strychninization of the posterior hypothalamus. Incidentally, they adduced evidence that impulses may also pass in the opposite direction—from the dorsomedial nucleus to the hypothalamus. Thus, since it has been well established on anatomical evidence that cortico-thalamic fibres connect the frontal areas with the dorsomedial nucleus, it is evident that hypothalamic activities may be indirectly influenced by the cerebral cortex through this pathway.

The nature of the impulses which are conveyed from the hypothalamus to the frontal cortex is not known, but evidence has accrued from the study of leucotomy cases that interruption of the projection fibre system from the dorsomedial nucleus can be to some degree correlated with the personality changes observed after this operation (see, in particular, the careful studies of A. Meyer & McLardy, 1949). It has also been reported by Spiegel *et al.* (1947) that bilateral lesions made surgically in the dorsomedial nuclei of the thalamus (as a substitute for frontal leucotomy) produce personality changes of a similar type. These observations are in harmony with those made previously on the association of mental deterioration with pathological affections involving the dorsomedial nuclei and periventricular system (Smyth & Stern, 1938), and may also be related to the well-known correlation between hypothalamic lesions and gross disturbances of emotional behaviour (see A. Meyer, 1944).

The anatomical details of the conducting system represented by the hypothalamus—→dorsomedial nucleus—→frontal cortex connexions are now fairly well known so far as the thalamo-cortical relationships are concerned. But they are still far from complete in regard to the hypothalamo-thalamic relationships. As already noted, the work of Murphy and Gellhorn indicates that impulses reach the dorsomedial nucleus from the posterior hypothalamus, but we do not yet know from which particular nuclear elements in this region. This is a problem which urgently needs elucidation by experimental anatomical methods.

Like the anterior nucleus, the dorsomedial nucleus of the thalamus has no representation in vertebrates other than mammals, and on these grounds alone may be presumed to subserve some of the more elaborate mental processes which depend on cortical activity. It appears to be present in all grades of mammals, but in primitive mammals the cortical area at the frontal pole of the cerebral hemisphere to which it projects is relatively very small (see Rose & Woolsey, 1947).

## [2. Efferent Cortico-Hypothalamic Connexions

We now come to a consideration of the anatomical pathways whereby cortical activities are enabled directly to influence hypothalamic functions—a problem of particular interest, since such pathways presumably form (at least in part) the basis for the apparently causal relationship which

has been noted to exist between higher mental processes and autonomic activities. In recent years the increasing accumulation of evidence has tended to emphasize the association of autonomic functions with certain specific regions of the frontal cortex. A review of this evidence also makes it apparent that, apart from the cingulate gyrus, there are two focal regions of what may be termed “autonomic representation” in the frontal lobe, one lying between the motor cortex and the frontal granular areas (the “cortico-autonomic belt” of Kennard, 1944), and the other on the orbital surface of the frontal lobe. This experimental evidence finds some confirmation from the clinical study of leucotomized patients, for it has been demonstrated that the more-posteriorly situated cuts in leucotomy (that is to say, involving the pre-motor and posterior orbital regions) are likely to be followed by autonomic disturbances (A. Meyer & McLardy, 1949). On the other hand, very few of these undesirable effects occur after strictly “prefrontal cuts”.

### *a. Fronto-Hypothalamic Connexions*

It has been recognized for some time that indirect pathways exist in the brain whereby impulses from the frontal lobe can be indirectly relayed to the hypothalamus through the septal and pre-optic regions, or the subthalamus. The first demonstration of *direct* fronto-hypothalamic connexions was made by Ward & McCulloch (1947), using the method of physiological neuronography. These authors mapped out descending connexions from certain specific areas of the frontal cortex (in particular the pre-motor and orbital regions) to certain specific nuclei of the hypothalamus, suggesting an elaborately organized pattern of connexions between these two functionally contrasted levels of the brain. By their technique, they traced cortico-hypothalamic fibres to the lateral and posterior hypothalamic areas, the mamillary body, and the supra-optic and paraventricular nuclei. The further study of these connexions is now being undertaken by direct anatomical methods in the Department of Anatomy at the University of Oxford, in order to define with greater certainty their precise distribution. These methods involve the ablation of specific areas of the cortex in macaque monkeys, and the study of the resulting terminal degeneration of cortico-fugal fibre systems a few days later with Glee's silver technique. The detailed results of these studies will be published elsewhere, but it is appropriate to summarize here some of the observations in relation to their possible functional implications.

One of the most interesting results of the degeneration experiments which we have been carrying out in the monkey is the demonstration of quite a massive projection of direct cortico-hypothalamic fibres from the postorbital cortex (an area practically equivalent to Walker's area 13), and also from the pre-motor cortex (area 6), to the ventromedial hypothalamic nucleus. This connexion is bilateral, the heterolateral fibres crossing in the rostrum of the corpus callosum, and passing through the pre-optic region in close association with the descending column of the fornix. It also appears probable that on both sides the fibres are finally conveyed to their termination by way of the medial forebrain bundle. The ventromedial hypothalamic nucleus, it should be noted, lies in the pars tuberalis of the hypothalamus, and its topographical position (or, at any rate, that of the adjacent part of the medial forebrain bundle through which afferent

fibres reach it) appears to correspond fairly closely with Hess's "intermediate zone of the hypothalamus", which this authority showed to respond to electrical stimulation by a complex syndrome of sympathetic discharge (Hess, Brügger & Bucher, 1946). A similar effect was noted by Wheatley (1944), who correlated the development of a type of "sham rage" with injuries localized to the ventromedial nucleus. Also apposite to these observations are those of Sachs, Brendler & Fulton (1949) who reported that, following the application of strychnine to the posterior orbital cortex, pronounced potential changes could be recorded in the region of the medial forebrain bundle in the hypothalamus. It is interesting to note that some of the autonomic effects which follow stimulation of this region of the hypothalamus may also be elicited by stimulating those areas from which the ventromedial hypothalamic nucleus mainly receives its cortical connexions, i.e. the posterior orbital cortex and the pre-motor cortex (see, for example, Bailey & Sweet, 1940; Delgado & Livingston, 1948; Kennard, 1944). According to our experimental anatomical studies, these cortical areas also send fibres, either directly or by collaterals, to the anterior hypothalamic area, the dorsomedial hypothalamic nucleus, and the periventricular arcuate nucleus, but these connexions are by no means so numerous as those which reach the ventromedial hypothalamic nucleus.

The demonstration of rather abundant cortical connexions with the ventromedial nucleus of the hypothalamus, and the physiological evidence that autonomic responses of various kinds may be obtained by electrical stimulation in this region, suggest that this hypothalamic element represents an important focal area for a number of fibre systems concerned with the control of autonomic functions. It is therefore of some interest to note that, in the human foetal brain, the ventromedial nucleus develops precociously and for a time appears as a relatively large and very circumscribed group of cells (Le Gros Clark, 1938). Later on in foetal development its outline becomes more diffuse and thus not so easily definable, probably in relation to the increasing complexity of its fibre connexions with adjacent regions of the hypothalamus and with more distant parts of the brain by way of the medial forebrain bundle.

So far, we have not been able with certainty to demonstrate anatomically any direct cortical connexions with the paraventricular and supra-optic nuclei (though these must be presumed to be present from the electrophysiological studies of Ward and McCulloch). The importance of such connexions has reference to the fact that these nuclei are closely linked by efferent fibres with the neurohypophysis, and a pathway is thus provided whereby pituitary functions may be influenced rather directly by the cortical activities of the frontal lobe.

#### *b. Connexions between Frontal Cortex and Mamillary Body*

Anatomical evidence for a direct fibre path from the frontal cortex to the mamillary body has been provided by the detailed study of brains which have been subjected to leucotomy operations (M. Meyer, 1949). From this evidence it appears that these fibres are mainly derived from the pre-motor cortex (area 6), and no doubt correspond to the connexions inferred by Ward and McCulloch to have their origin in the corresponding area (6a) in the monkey's brain.

The cortico-mamillary fibres terminate mainly in the caudal part of the main or medial mamillary nucleus, and it seems probable that they reach their objective by passing through the internal capsule and traversing the subthalamic area. The function of this system is not known, for the reason, already noted, that nothing is really known of the functional significance of the mamillary body.

#### *c. Limbic Cortex and Hippocampus*

We have made mention of two main efferent systems linking the neopallial cortex directly with the hypothalamus. Another efferent system, less direct, is of course that represented by the limbic cortex and hippocampus to which reference has already been made. From our experiments on the monkey brain, using the method of terminal degeneration, it is clear that efferent fibres extend back from the gyrus cinguli (area 24) to the retrosplenial areas of cortex, and there is good reason to suppose that these areas in their turn supply afferent fibres to the hippocampus from which the fornix system mainly arises. But there is evidence that a small proportion of the fibres of the fornix take their origin directly from the limbic cortex, and the latter is thereby brought into much more direct relationship with the mamillary body. Further experimental studies in our laboratory (Sprague & M. Meyer, 1950) have recently made it evident that, in the rabbit, the fornix terminates mainly in the basal and intermediate parts of the medial mamillary nucleus. None appears to reach the lateral nucleus. It should be noted, also, that some fibres of the fornix definitely leave the main fascicle to end in the septal region (and possibly the anterior hypothalamus), while others extend back beyond the mamillary body towards the tegmental region of the midbrain. Lastly, contrary to the usual textbook description, it has not been found possible to detect any contribution from the fornix to the habenular region by way of the stria medullaris.

### 3. Conclusion

The more or less direct anatomical connexions between the neopallial cortex and the hypothalamus which we have briefly described in this review are those which have now been defined with considerable certainty by anatomical or electrophysiological methods. Taken by themselves, they evidently betoken a much closer functional relationship between these contrasting levels of cerebral organization than might have been supposed a few years ago. In conjunction with the evidence of physiological experimentation, they also make it clear that there are certain topographical regions of the cerebral cortex which are specifically concerned with this relationship, in the sense that they are more intimately connected than other areas with autonomic effector mechanisms in the hypothalamus. The importance of these relationships seems clear, for they evidently provide for the integration of primitive autonomic mechanisms (such as are associated, for example, with instinctive urges and emotional reactions) with neural activities taking place at the highest functional levels of the brain. It is not surprising, therefore, that interference with this system should lead to psychological disturbances affecting the very structure of what is usually termed "personality". No doubt it is still far from clear precisely what part is played in these high-level integrations by the anatomical connexions to which we have referred. But clinical and

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## THE HYPOTHALAMUS AND ENDOCRINE GLANDS

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- 1 Adrenal medulla and neurohypophysis
  - a Adrenal medulla
  - b Supraoptico-hypophyseal tract
  - c Secretion of antidiuretic hormone
- 2 Adenohypophysis and the gonads, thyroid and adrenal cortex
  - a Mode of transmission of stimuli
  - b Effect of sectioning pituitary stalk
  - c Secretion of adrenocorticotrophic hormone
- 3 Conclusion
- References

The internal environment of the body is controlled by the autonomic nervous system and by humoral means. It seems likely that adjustments of the internal milieu mediated by these two mechanisms are integrated in the hypothalamus. Hypothalamic control of the autonomic nervous system has been the subject of intense study. Following the pioneer work of Karplus and Kriedl, many schools took up this field of investigation with particular regard to the quicker reactions concerned with the control of the blood-pressure, respiration, body temperature and similar functions. This aspect of hypothalamic physiology has been ably summarized in many reviews (Ranson & Magoun, 1939; Ranson, 1940; Miller,

1942; Hess, Brügger & Bucher, 1945-6). However, hypothalamic control of humoral mechanisms such as the slower metabolic and endocrine processes has received much less attention, and it may be said that little is known of the interrelation between the central nervous system and the ductless glands. Except for the adrenal medulla and the neurohypophysis (posterior pituitary gland), the position of endocrinology today may be likened to that of the vascular system if the function of vagus and sympathetic nerves were as yet undiscovered. That the reproductive and other endocrine functions are brought into harmony with the external environment and general somatic requirements is well established, but the investigation of the mechanism whereby such co-ordination is brought about is only in its opening phases. This review deals with such work.

### 1. Adrenal Medulla and Neurohypophysis

These two glands are exceptional in the endocrine series in that they are closely associated with the central nervous system in development, being derived from neural crest material and from the diencephalon, and both are dependent on a rich nerve supply for normal function throughout life.

#### a. Adrenal Medulla

The adrenal medulla is supplied by the splanchnic nerves and by the upper lumbar sympathetic chain (Swinyard, 1937; Young, 1939), and if these nerves are cut it is doubtful whether the gland continues secreting. It certainly becomes inexcitable to electrical stimuli that elicit secretion in the normal gland (Cannon & Rosenbleuth, 1937). Houssay & Molinelli (1925), using a crossed circulation technique, showed that stimulation of the infundibular region of the hypothalamus elicits secretion by the adrenal medulla in dogs, which is abolished by section of the great splanchnic nerve. Magoun, Ranson & Hetherington (1937) likewise found that stimulation of the hypothalamus resulted in release of adrenin into the circulation, the loci active to stimulation being situated

## CEREBRAL CORTEX AND HYPOTHALMUS

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experimental enquiries are beginning to demonstrate how important they may be, and it seems to us that these enquiries may be considerably facilitated in the future if those who pursue them are

made familiar with the essential anatomical data concerned. This, indeed, is the main reason why we have prepared this short review.

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in the anteroposterior extent of the lateral hypothalamic area and the adjacent perifornical region. It would seem clear from this and other evidence that the hypothalamus influences adrenaline secretion, as part of general sympathetic control, by means of a pathway through the brain stem, spinal cord and splanchnic nerves; and that in the hypothalamus the activity of the adrenal medulla is co-ordinated with the requirements of the organism under varying patterns of emotional excitement.

#### *b. Supraoptico-Hypophyseal Tract*

The neurohypophysis is innervated by a very rich tract of unmyelinated fibres descending to the gland in the neural stalk. These fibres originate mainly in the supraoptic nucleus, some in the paraventricular nucleus and possibly other hypothalamic nuclei (for discussion, see Harris, 1948a). Functionally, the most important tract appears to be the supraoptico-hypophyseal (SOH) tract, as first shown by the classical work of Ranson and his colleagues (Fisher, Ingram & Ranson, 1938). These workers found that bilateral lesions of this tract were followed by loss of secretory activity of the neurohypophysis with a resultant state of diabetes insipidus, by degeneration and atrophy of the neurohypophysis and of the supraoptic nucleus, and by a loss of active material (antidiuretic, oxytocic and pressor) extractable from the glands. For the first time the relationship between the hypothalamus and pituitary gland and the water balance of the body, and the analysis of clinical cases of diabetes insipidus, were on a sound basis. The effect of similar lesions on the oxytocic activity of the gland and the mechanism of parturition is not clear cut. Fisher, Magoun & Ranson (1938) and Dey, Fisher & Ranson (1941) found that lesions of the SOH tract in cats and guinea-pigs were followed by dystocia in a high proportion of cases, though some animals that exhibited a state of diabetes insipidus delivered their young normally. It has been reported that clinical cases of diabetes insipidus may suffer from dystocia (Marañón, 1947), and the position has been discussed (Harris, 1948b).

The converse experiments, electrical stimulation of the SOH tract with resultant positive responses from the neurohypophysis, have been technically difficult to perform, since anaesthesia itself tends to inhibit water diuresis, against the background of which the antidiuretic effect is observed. However, Haterius (1940), Haterius & Ferguson (1938) and Ferguson (1941) made the experiment in anaesthetized rabbits and cats and obtained evidence that electrical stimulation of the pituitary stalk causes secretion of the antidiuretic and oxytocic hormones. The experimental procedure was much simplified when remote control stimulation was applied to the hypothalamic region and it became possible to stimulate different regions without the use of an anaesthetic. In a preliminary operation a small coil was buried between the scalp and skull of a rabbit and an insulated electrode carried down through the skull, corpus callosum and other median structures into some part of the hypothalamus or pituitary gland. After recovery from the initial operation, stimulation could be performed in the conscious state by placing the animal with its head in an electro-magnetic field. Using this method it was found that localized stimulation of the SOH tract produced secretion by the neurohypophysis and, as a result, the following reactions occurred—inhibition of a water diuresis; an increase in the relative, and sometimes absolute, urinary chloride; a marked increase in uterine activity in the oestrous,

or oestrogenized rabbit, but no increase in the pseudopregnant animal or animal treated with progesterone; an increase in intestinal activity; only slight rises in blood-pressure of the same type as those produced by injection of posterior pituitary extract; no increase in blood-sugar; and the appearance of an antidiuretic substance in the urine (Harris, 1944 (thesis for M.D. degree, Cambridge University); 1947a, 1948d, 1948e). It is of interest that the secretion produced by stimulation of the SOH tract appears to possess relatively more oxytocic than pressor activity as compared with standard posterior pituitary extracts. For example, maximal stimulation of the tract for 1 min. causes the secretion of the equivalent of 200–500 mU oxytocic factor and less than 100 mU pressor factor. The fact that the rabbit possesses a mechanism for increasing the activity of the empty oestrous uterus may be significant in relation to sperm transportation during and after coitus (Harris, 1948f).

#### *c. Secretion of Antidiuretic Hormone*

The changes in the external environment and internal milieu which in the normal animal elicit secretion of the antidiuretic hormone, and the mechanism whereby such changes affect the neurohypophysis, have been the subject of a series of investigations by Verney and his colleagues. Their work has firmly established the posterior pituitary antidiuretic secretion as a true hormone. Rydin & Verney (1938) investigated the inhibition of a water diuresis produced by muscular exercise. They found the inhibiting factor was the emotional accompaniment of the exercise, and showed that the effect of emotion was not mediated by the nerve supply of the kidney, or by the participation of haemodynamic factors. They suggested that the antidiuretic effect of emotion was humorally conducted to the kidney, and they produced strong indirect evidence that the humoral agent was the pituitary antidiuretic hormone. O'Connor & Verney (1942) then found that removal of the posterior pituitary gland in dogs reduced the emotional inhibition of a water diuresis to 5 per cent of its original magnitude. Section of the SOH tract (O'Connor, 1946) also very largely abolished the emotional inhibition of a diuresis. Much of this work was performed on dogs in which the kidneys and adrenals had been denervated.

In further work, on dogs with intact sympathetic systems, O'Connor & Verney (1945) distinguished a second type of emotional inhibition of a diuresis. The inhibition of pituitary origin is slow and prolonged, but this second type was rapid in onset and evanescent in duration. After denervation of the adrenal glands and kidneys, a long slow inhibition was apparent in all cases. It did appear, then, that an intact sympathetic system may prevent the development of an inhibition of pituitary origin. It was then found that injection of adrenaline immediately prior to an emotional stress stimulus likewise prevented any pituitary-type inhibition of a water diuresis, although adrenaline did not prevent an inhibition following the injection of posterior pituitary extract. Further work (Verney, 1947) showed that tyramine acts in a similar manner to adrenaline, and it is thought that the most likely mode of action is through interference with the chemical reactions initiated in the nervous system by the emotional stress stimulus. Attention was then turned (Verney, 1946, 1947) to the effect of changing the osmotic pressure of the blood on the secretion of the antidiuretic hormone by the posterior pituitary gland. It was found that intracarotid injections of hypertonic sodium chloride over a 5–20 sec. period caused a

release of antidiuretic hormone with resultant inhibition of a water diuresis, the response being diminished by some 90 per cent after removal of the posterior lobe. This response was shown to be osmotically determined, the receptive elements being situated somewhere in the vascular bed of the internal carotid artery. The osmoreceptors were shown to be freely permeable to urea, less freely permeable to dextrose, and relatively impermeable to sodium chloride and sucrose. A local increase in osmotic pressure of only 2 per cent (in experiments involving intracarotid infusions lasting 40 min.) was found to cause an antidiuresis which had a postpituitary extract equivalence of  $1\mu\text{U/sec}$ . The change in blood-chlorides in these latter experiments is within the range of changes found physiologically in man. It would seem likely that the osmoreceptors postulated by Verney lie within the supraoptic nucleus of the hypothalamus. This nucleus possesses an exceedingly rich blood supply, which is a likely attribute of a chemoreceptor, but there is as yet no proof that it is the location of the receptive structure.

Since emotional stress excites the secretion of the antidiuretic hormone it would seem probable that the supraoptic nucleus is in turn excited by afferent nerve tracts from other regions. There is evidence that these tracts are cholinergic in nature. Pickford (1939) showed that intravenous injection of acetylcholine into the dog inhibited a water diuresis, but that the inhibitory effect could not be produced after removal of the posterior pituitary gland. Burn, Truelove & Burn (1945) found that nicotine had a similar action in man. These experiments did not definitely localize the site of action of acetylcholine or nicotine as being in the supraoptic nucleus, but Pickford (1947) has further shown that injections of  $0.004\text{ cm}^3$  (totalling from 2 to  $40\text{ }\mu\text{g}$ .) of acetylcholine solution directly into the supraoptic nucleus of chloralosed dogs interrupts the course of a water diuresis. Further interesting work by Pickford and her colleagues (personal communication, 1949) has disclosed that injection of di-isopropylfluorophosphonate (DFP), an inhibitor of cholinesterase, into the supraoptic nuclei of chloralosed diuretic dogs results in an immediate inhibition of the water diuresis, followed by a delayed effect in which marked polyuria and polydipsia occur and persist for 4–9 days.

Summarizing the evidence concerning hypothalamic control of the neurohypophysis, it may be said that anatomically the neurohypophysis has a rich innervation from the supraoptic nucleus; that lesions of the supraoptico-hypophyseal tract produce diabetes insipidus and atrophy of the neurohypophysis; that stimulation of the tract causes secretion of the antidiuretic (pressor) and oxytocic factors; that the supraoptic nucleus is stimulated (either directly or indirectly) by changes in the osmotic pressure of the blood, and by cholinergic nerve tracts from other regions of the brain subserving emotional and possibly other reactions.

## 2. Adenohypophysis and the Gonads, Thyroid and Adrenal Cortex

The crucial problem in endocrinology at the present time is the inter-relationship between the central nervous system and the anterior pituitary gland, gonads, thyroid and adrenal cortex. It is beyond doubt that neural processes influence the internal secretion of these glands, and that the hormones liberated react back on the nervous system, so producing

profound behaviour changes; but the mechanisms involved are largely conjectural.

There is much evidence that the anterior lobe of the pituitary gland is under the influence of the nervous system and that, through the eutrophic pituitary hormones, the gonads, thyroid and adrenal cortex are brought indirectly under neural control (see Harris, 1948a). As examples of such an influence may be quoted: (i) the important observations of Marshall (1922, 1936, 1942) on the effect of the external environment on reproductive processes; (ii) the fact that small localized tumours in the region of the tuber cinereum may produce precocious puberty in young children (Weinberger & Grant, 1941); (iii) the well-known disturbances that may occur in the menstrual rhythm or in the process of lactation due to psychological disturbances such as worry, fright, hypnosis; (iv) the effect of the environmental temperature on thyroid histology (Uotila, 1939; Brolin, 1945); and (v) the effect of emotional and other types of stress on the histology and activity of the adrenal cortex (Sayers & Sayers, 1948). It seems highly probable that these effects are produced by means of the hypothalamo-adenohypophyseal system.

### *a. Mode of Transmission of Stimuli*

The anatomical pathway by which the hypothalamus influences anterior pituitary secretion has been the subject of much debate. Most workers have found, on microscopic examination, that the anterior pituitary gland possesses a scanty nerve supply. These findings, and the fact that the anterior pituitary gland possesses a rich reticular fibre framework which may stain by silver methods to give the appearance of nerve fibres, put the onus of proof on those authorities who claim to have found many nerve fibres in the gland. Such claims now need the substantiation of two control procedures: firstly, to stain alternate sections for nerve fibres and reticular fibres and compare the fibre patterns disclosed; and secondly, to stain simultaneously sections from a normal gland and a "denervated" gland (after cervical sympathectomy and pituitary stalk section), in order to demonstrate the presence of nerve fibres in the normal gland, and the absence in the "denervated" gland. At the present time, it may be said that there is no convincing histological evidence of secretory nerves in the pars distalis of the adenohypophysis.

The same conclusion may be drawn from the experimental evidence available. Three nervous pathways have been suggested as possible routes for hypothalamic control of the anterior pituitary: the cervical sympathetic system, the parasympathetic fibres of the petrosal nerves, and the hypothalamo-hypophyseal tract in the pituitary stalk. Section of these various nerves, however, does not necessarily prevent neural processes from affecting anterior pituitary secretion.

Apart from the nerve tracts mentioned above, another anatomical pathway exists connecting the median eminence of the tuber cinereum and the anterior pituitary gland. Rainer of Bucharest noticed, in human autopsy material, blood-vessels running longitudinally along the pituitary stalk. One of Rainer's pupils, Popa, working in collaboration with Fielding, first described these vessels in detail (Popa & Fielding, 1930, 1933). On histological grounds they claimed that blood was collected from the sinusoids of both lobes of the pituitary, carried upwards in large vascular trunks along the pituitary stalk, and redistributed by a secondary net of capillaries in the hypothalamus. For this reason the authors

termed the vessels "hypothalamo-hypophysial portal vessels". Wislocki & King (1936) and Wislocki (1937, 1938) confirmed the presence of these vessels, but differed from Popa & Fielding in claiming that the vessels started in the median eminence of the tuber cinereum, that the direction of flow was from above downwards, and that the vessels ended entirely in the pars distalis of the pituitary. Since the median eminence is, strictly speaking, part of the neurohypophysis rather than of the hypothalamus, the vessels were renamed the "hypophysial portal vessels". Green & Harris (1947) re-investigated the region in a variety of mammals and largely confirmed the findings of Wislocki. They found that small arterial twigs, branches of the internal carotid or posterior communicating arteries, run to supply a large vascular plexus situated between the pars tuberalis and median eminence. From this plexus arises a multitude of wide capillary loops which penetrate into the tissue of the median eminence where they come into intimate relationship with the nerve fibres of the hypothalamo-hypophysial tract. The blood from these loops is drained by means of large portal trunks running in the pars tuberalis envelope of the neural stalk, these trunks breaking up and redistributing the blood into the sinusoids of the pars distalis. The exact pattern of these vessels varies in detail in different mammals. In animals with short pituitary stalks, such as the dog, the intermediate trunks of the portal vessels may be likewise short and the two terminal sets of capillaries approximated, but in forms where the stalk is elongated, as in man, the portal trunks are also long. Green (1947, 1948, 1949; personal communication, 1949) has recently made a thorough investigation of the portal vessels in many types of vertebrates and finds a similar system of vessels in all forms examined from the Salientia to the Primates. Even in the porpoise and the whale (forms in which the anterior and posterior lobes of the pituitary gland are separated by a septum of thick connective tissue) a well-marked portal system of vessels is present and connects the median eminence and pars distalis by passing anterior to the septum (Harris, 1947b; unpublished observations, 1949). It has been suggested that, embryologically, the portal vessels are related to the lateral lobes of Rathke's pouch; and the significance of the pars tuberalis, which is derived from the lateral lobes, lies in the fact that it forms a bed for the vascular pathway between the nervous system and pars distalis (Harris, 1947c). The direction of blood-flow in the portal vessels has been a subject of much controversy. Direct microscopic examination of the vessels in living amphibians (Green, 1947) and rats (Green & Harris, 1949) has established that the blood flows from the median eminence to the pars distalis of the pituitary. To complete this summary of the blood-vessels of the gland, it may be added that, besides a portal system of supply, the pituitary receives a systemic arterial supply by means of branches from the internal carotid artery, and that the venous drainage is by wide veins which pass laterally into the adjacent venous sinuses.

In view of the above anatomical facts it was suggested (Harris, thesis, 1944; Green & Harris, 1947) that the hypothalamus may influence the secretion of the adenohypophysis by means of a neurovascular link, viz., that hypothalamic nerve fibres end in close relation to the capillary loops in the median eminence and, on excitation, liberate some chemo-transmitter into these vessels, this substance being transported by the portal vessels to excite or inhibit the pars distalis of the gland. It may be said that the experimental evidence avail-

able lends strong indirect support to the theory of neuro-vascular transmission of stimuli.

#### *b. Effect of Sectioning Pituitary Stalk*

Very varied effects have been recorded by different workers after sectioning the pituitary stalk. To take one example, the effect of pituitary stalk section on the oestrous cycles and reproductive processes in rats has been studied in detail. Following this operation, Richter (1933) found that oestrous cycles were prolonged, Westman & Jacobsohn (1938a, 1938b), and Brolin (1945) reported gonadal atrophy, whilst, on the other hand, Dempsey & Uotila (1940) and Dempsey & Searles (1943) found that some animals showed normal reproductive processes. Similarly, diverse results have been reported by workers who have studied the effects of stalk section on other pituitary functions such as lactation, maintenance of the thyroid and adrenal glands, and carbohydrate metabolism. The conclusion that may be drawn from these results is that the nerve fibres of the stalk are not of importance to anterior pituitary activity, since some animals display normal pituitary functions after stalk section, and the nerve fibres involved have no power of regeneration.

In an attempt to discover whether the portal blood-vessels of the stalk regenerate after section, and whether any regeneration could be correlated with the postoperative return of pituitary activity, the above experiments on stalk section in rats have been repeated. Harris (1949; and unpublished observations, 1949) found that regeneration of the hypophysial portal vessels and the return of oestrous cycles occurred in a high proportion of rats following pituitary stalk section. A second series, of 32 rats, in which small foreign bodies (usually paper plates) were placed between the cut ends of the stalk in an attempt to prevent such regeneration, was also studied. Fifteen of these latter animals remained anoestrous, and serial sections showed that in these cases the foreign body had been accurately placed and that no vascular regeneration had occurred. Of the other 17 animals in this group, 11 showed the return of irregular, and 6 the return of regular, oestrous cycles; histological examination showed a good correlation between the amount of regeneration of the portal vessels (allowed by misplacement of the foreign body) and the return of cycles.

The questions of what areas of the hypothalamus are concerned with the control of anterior pituitary secretion, and of how such control is mediated, are important; electrical stimulation of different regions of the hypothalamus and pituitary gland was applied in an effort to obtain relevant data. It is well known that under normal conditions ovulation in the rabbit involves coital excitation of a nervous reflex followed by anterior pituitary secretion and so follicular rupture. Using the remote control method (described in Section 1b above), it was shown (Harris, 1948c) that electrical stimulation of the tuber cinereum for 3 min. may be followed by a full ovulatory response, whereas similar stimuli applied directly to the pars distalis, pars intermedia or infundibular stem for periods up to 7½ hr. were not followed by ovulation. These experiments were performed in conscious rabbits so that different levels of anaesthesia could not be concerned with variations in response to stimulation. The theory of neurovascular transmission of stimuli accords well with the facts that stimulation of nerve fibres in the tuber cinereum of the hypothalamus excites anterior pituitary secretion of the gonadotrophic hormone, whereas stimulation of the nerve

fibres in the pituitary stalk (infundibular stem) or stimulation of the anterior pituitary itself does not result in secretion. If the anterior pituitary gland lacks secretomotor nerve fibres and is humorally excited via the portal vessels, it seems likely that the gland would be inexcitable to electrical stimulation.

### *c. Secretion of Adrenocorticotrophic Hormone*

Since the mechanism of ovulation in the rabbit is rather exceptional among mammals, it appeared doubtful how far the above results could be applied to anterior pituitary secretion in general. That such application was valid appeared likely when it was found in a few rabbits that prolonged stimulation of the tuber cinereum resulted in a glycotropic response, that is, a marked decrease in sensitivity to the injection of small doses of insulin (Harris, unpublished observations, 1949). However, a more detailed study of the mechanism underlying the secretion of adrenocorticotrophic hormone (ACTH) by the anterior pituitary gland of the rabbit has been made. It is known that injection of ACTH in rabbits and other animals produces a temporary but marked fall in the absolute number of blood lymphocytes (Dougherty & White, 1943, 1944), and that emotional stress stimuli in mice and rats (Selye & Harlow, 1937) and in man (Pincus, 1947) produce a similar lymphopenia. It was found (Colfer, de Groot & Harris, unpublished observations, 1949) that emotional stress stimuli (restraint or subcutaneous faradism) constantly evoked a lymphopenic response in normal rabbits, but not in hypophysectomized animals, though injection of ACTH still produced a response after hypophysectomy. It was also shown that the adrenal medulla played no part in the lymphopenic response.

There was then available for investigation a reaction in the rabbit which could be indicated: emotional stress (neural excitation) → anterior pituitary gland → adrenal cortex → lymphopenia. To see whether the secretion of ACTH and a resultant lymphopenia could be evoked by hypothalamic stimulation, de Groot & Harris (unpublished observations, 1949) used the remote control method of stimulation with the primary coil enlarged to encircle the cage containing the rabbit. Thus the animal was in its usual surroundings and free to move, eat, groom the fur and so on during the period of stimulation and was not subject to concurrent emotional stress. It was found that the stimulation of the posterior region of the tuber cinereum and mamillary body resulted in a lymphopenia which was similar in time relations and magnitude to that following an emotional stress stimulus or injection of ACTH. Cervical sympathectomy did not abolish the response. Stimulation of other regions in the hypothalamus (including the supraoptico-hypophyseal tract) and pituitary (pars and zona tuberalis, pars distalis, pars intermedia and infundibular stem) did not elicit the response. Some further observations were made (de Groot & Harris, unpublished observations, 1949) on the effect of various hypothalamic and pituitary lesions on the lymphopenia which normally follows an emotional stress stimulus. In two rabbits in which the zona tuberalis (the part of the anterior pituitary gland of the rabbit traversed by the portal vessels) was destroyed, and in some

other animals in which the posterior part of the tuber cinereum or mamillary body was damaged, the lymphopenic response to stress was diminished or abolished. Thus, as in the case of the studies of gonadotrophic secretion, the theory of neurovascular transmission of stimuli is in accordance with the facts.

From the above, it appears that anterior pituitary secretion is influenced by nervous structures in the posterior wall of the tuber cinereum. Through this complex region passes the tubero-hypophyseal tract and, although there is no direct evidence implicating this tract, it seems likely that it is concerned with the activity of the adenohypophysis.

It is of interest that from a different approach, Markee and his colleagues in America (Markee, Sawyer & Hollinshead, 1948; Sawyer, Markee & Townsend, 1949; Sawyer, Everett & Markee, 1949; Everett, Sawyer & Markee, 1949) have reached the conclusion that hypothalamic control of gonadotrophic secretion by the anterior pituitary gland of the rat and rabbit is humorally mediated by an adrenergic mechanism.

### 3. Conclusion

There can be little doubt that the majority of endocrine glands are under the control of the nervous system. The adrenal medulla and neurohypophysis are controlled by a rich, direct secretomotor innervation, whereas the adenohypophysis (and thus indirectly the thyroid, adrenal cortex and gonads) is probably brought under neural control by a local vascular link, the hypophyseal portal blood-vessels. The hypothalamus forms an essential part of the neural mechanism influencing the endocrine series.

One of the striking facts emerging from recent work is the emphasis on emotional and psychological factors in the control of endocrine secretion. The relationship between emotional stimuli and the secretion of the adrenal medulla has long been known, but it is now apparent that the secretion of the antidiuretic, gonadotrophic and adrenocorticotrophic hormones from the pituitary gland may also be influenced by emotional states. It may be that the frontal cortex-hypothalamic relationship, which Fulton (1949) has recently emphasized in reference to the autonomic nervous system, is also of importance to the function of the endocrine glands. Eighteen years ago Le Gros Clark (1932) pointed out the importance of the fibre tracts uniting the cortex of the frontal lobe and the dorsomedial thalamic nucleus, and of the periventricular fibres which connect the dorsomedial thalamic nucleus and hypothalamus. Le Gros Clark suggested that this anatomical system links up a dualism of psychic life, the hypothalamus concerned with the internal environment (visceral activity and the pituitary gland) and the emotions, and the thalamus concerned more with stimuli arising in the external environment. The operation of frontal lobotomy has again focused attention on the fronto-thalamic connexions and it is of interest that there are many reports of cases, such as that of Hemphill (1944), in which lobotomy has resulted in a marked change in endocrine activity.

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## THE AUTONOMIC SYSTEM OF MAN: DIGITAL VASOMOTOR RESPONSES

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- 1 Vascular changes associated with changes in respiratory rhythm
  - 2 Responses to various stimuli
  - 3 Blood-pressure changes in spinal man
  - 4 Responses in opposite limb and in veins
  - 5 Vasodilator function of the sympathetic nervous system
  - 6 Conclusions
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In man there are two main motor divisions of the nervous system. The first—the somatic efferent system—is concerned with the volitional control and reflex activity of skeletal muscle. The second—the autonomic nervous system—controls the activity of smooth muscle and glandular tissue. Anatomically the peripheral portions of these two systems are relatively distinct. The autonomic nervous system differs from the somatic in having an outflow to ganglia situated either along the side of the vertebral column or in close proximity to the tissues served by it. Like the somatic efferent system it has central connexions, which play a considerable part in governing its activities. The purpose of this communication is to discuss the recent work of several observers who have been concerned mainly with eliciting information regarding the nervous control over digital blood vessels and to place on record some further observations made in subjects with lesions of the spinal cord.

### 1. Vascular Changes Associated with Changes in Respiratory Rhythm

By the use of the finger plethysmograph, Goetz (1935) demonstrated that changes took place in the peripheral vascular bed following a deep breath. Using similar methods Bolton, Carmichael & Stürup (1936) made an especial study of the changes associated with alteration in the respiratory rhythm: they found that following a deep inspiration the volume of the finger decreased, and they noted that this response occurred nearly simultaneously in the digits of all four limbs; as this response was absent in the digits of a limb previously sympathectomized they considered that the response was mediated through activity of the peripheral sympathetic system and that therefore the response was in the

nature of a vasoconstrictor reflex. Carrying their studies further, they concluded that the reflex was initiated by a stimulus associated with expansion of the chest wall during the inspiratory phase of the deep breath, and that the afferent stimuli were mediated by the intercostal nerves. Gilliatt (1948) re-investigated this reflex. In trained subjects he was unable to detect any appreciable difference between the response to thoracic inspiration and that to abdominal inspiration; he also found that the response was not connected with the fall in blood-pressure occurring during inspiration. He was thus unable to substantiate the assumption of Bolton *et al.* (1936) that the reflex was mediated by the intercostal nerves; at the same time he offered no information as to the probable site of the afferent nerve-endings responsible for this response. It would appear, however, that the afferent pathway for the response must reach the cord through the upper thoracic spinal nerves. Gilliatt, Guttman & Whitteridge (1948) found in a series of patients with spinal injuries that, with lesions at the level of the lower cervical segments, deep inspiration caused constriction in the vessels of the fingers and often in the vessels of the toes; with lesions below the sixth thoracic segment no response in the toe occurred. Though there is considerable variability in the responses in the toes, the observations of these authors suggest that the entry for the afferent impulse is between the first and sixth thoracic roots.

### 2. Responses to Various Stimuli

Such responses, being constrictor in quality, were more readily observed when the digital vessels were in a state of dilatation. To obtain this state body-warming was essential, and the method used by Bolton *et al.* (1936) was that of immersion of indifferent limbs in water at 44–45° C. This method had been shown by Uprus, Gaylor & Carmichael (1936) as the most satisfactory for producing rapidly, and sustaining steadily, a state of vasodilatation of digital vessels. These authors demonstrated the difficulties in obtaining satisfactory vasodilatation of digital vessels by exposure to radiant heat and drew attention to the need for an adequate rise in blood temperature. It will be noted that, in a subject with a spinal lesion causing complete interruption of spinal pathways, vasodilatation of finger vessels could still be fully initiated by immersion of the insensitive legs in water at 44–45° C., but a greater rise of blood temperature was required than in healthy subjects. In subjects so warmed, Stürup *et al.* (1935) were able to obtain constrictor reflexes to a variety of stimuli—cutaneous and visceral pain, loud noise, cold, etc. In response to such stimuli the reflex occurred in all four limbs simultaneously. On occasions, without any known stimulus having been given, vasoconstriction could be noted as occurring, sometimes in the vessels of the toes alone and at other times in the vessels of the digits of all four limbs. These constrictions were examined by Doupe, Robertson & Carmichael (1937), who noted that they took place more frequently in the vessels of the toes and that when observed in the digits of all four limbs the degree of change was greater in the vessels of the lower limbs than in those of the upper limbs. As such spontaneous constrictions did not appear in the records obtained from the digits of a limb which had been previously sympathectomized, these authors believed that they were dependent upon the integrity of the sympathetic nervous system. They further observed that following a

variety of stimuli, such as cutaneous pain or sensation of cold induced by application of ice to an indifferent area of the body, digital vasoconstriction resulted, again more readily and to a greater extent in the vessels of the toes than of the fingers. This difference both in spontaneous and provoked responses was found to be absent in subjects with lesions of the cauda equina: the lesion had to be extensive enough to include the first sacral and lower lumbar roots, thereby producing sensory loss in the feet and calves. In such lesions, there was retention of the integrity of the peripheral sympathetic pathway, the outflow of which was above the level of the lesion: the vessels of the toes thus remained under active control of the sympathetic nervous system. In view of the absence of "spontaneous" vasoconstriction, combined with the greater response in the toe vessels in such patients, it was deduced that in the healthy subject the central nervous system was bombarded by afferent impulses from the leg area, which impulses tended to make it more easy to induce vasoconstriction in the vessels of the toes than elsewhere. Such a deduction might in part explain the observation of Lewis & Pickering (1931) and Pickering & Hess (1933) that vasodilatation was more easily obtained in the vessels of the fingers than of the toes. As far as is known to the present author, similar observations have not been made on animals. It may well be that, with the assumption of the erect posture, man has evolved an added means of controlling the blood supply, especially to the most dependent parts of the body.

As already noted, many forms of noxious stimuli, such as loud noise, flash of light, cutaneous pain, visceral pain and cold, produce vasoconstrictor responses. Carmichael *et al.* (1939) showed that distension of the duodenum also produced similar responses in the vessels of the fingers and toes; and not infrequently these responses followed a degree of distension which produced no conscious sensation. In later work (unpublished), these authors also found that similar results were obtainable in healthy subjects when the rectum was distended or the pressure within the bladder rapidly raised by injection of saline through a catheter.

### 3. Blood-Pressure Changes in Spinal Man

More recently, in patients with gun-shot wounds of the spinal cord, Guttmann & Whitteridge (1947) found marked changes in blood-pressure following distension of the bladder. As several of their subjects had lesions of the spinal cord at the level of the lower cervical segments; i.e. above the level of outflow of the sympathetic efferent fibres, the rise in blood-pressure resulted from activation of essentially spinal mechanisms. As they demonstrated a diminution in blood-flow in the fingers coincident with the rise in blood-pressure, it was taken that in spinal man digital vasoconstrictor reflexes could be elicited following a visceral stimulus.

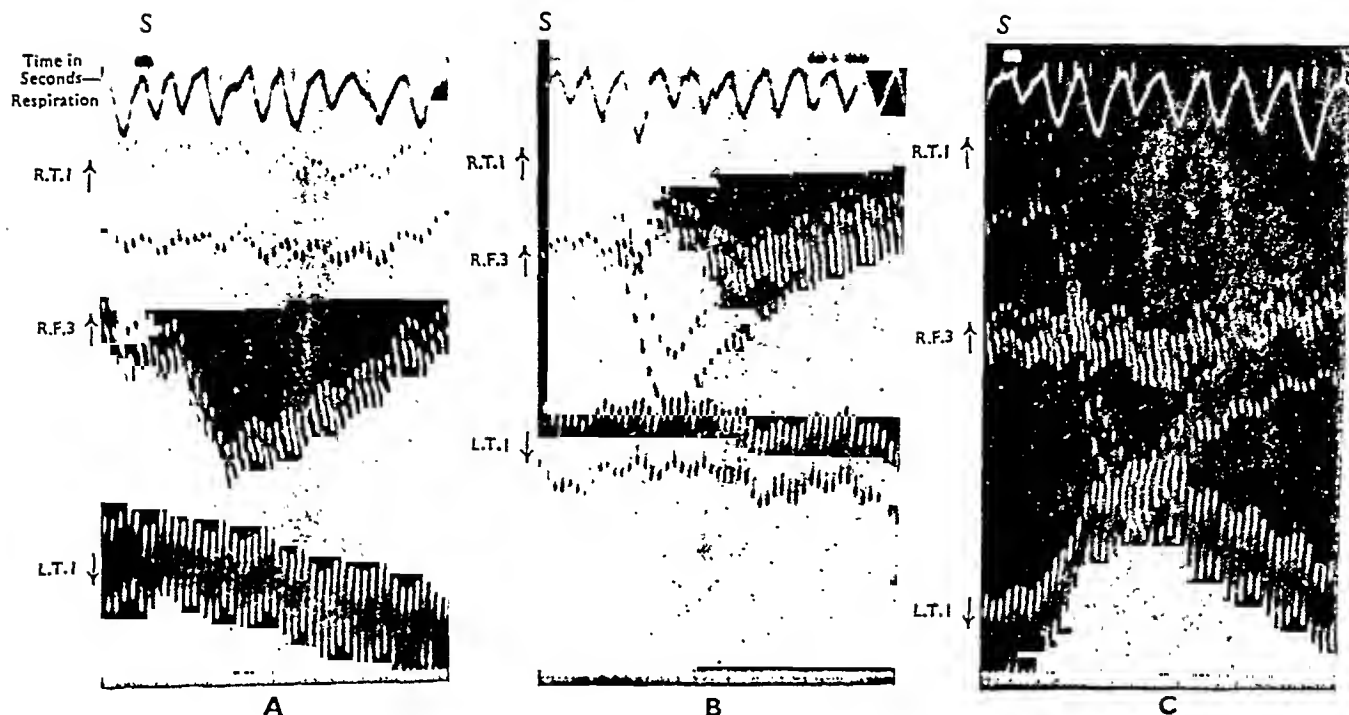
In a series of patients suffering from traumatic or vascular lesions of the spinal cord it has been possible to examine in further detail the vasomotor reflexes. After having assured a steady state of vasodilatation of the digital vessels by immersion of one arm in water at 44–45° C., the responses of the vessels of the other hand and both feet were studied. In one subject, in whom as the result of a traumatic lesion of the spinal cord at the 8th thoracic segment there was an absence

of sensation below that level, pin-prick or cold applied to the face or shoulders resulted in a ready vasoconstriction of the vessels of the fingers only. When a similar stimulus was applied to the lower abdomen or legs, vasoconstriction occurred only in the vessels of the toes; even when the stimulus was greatly increased, no response was observed in the vessels of the fingers. As already noted, vasomotor responses are more active in the toes than in the fingers in healthy subjects, irrespective of the site of the stimulus; hence the absence of vasoconstriction of the vessels of the toes in response to a stimulus applied to the upper half of the body may be taken as evidence that the descending pathways in the cord had been interrupted. Again, as even with severe stimuli to the lower half of the body nothing occurred in the finger vessels except, at most, a slight increase in volume probably due to the increase of blood-pressure, the ascending pathways in the spinal cord had also been interrupted. Thus vasoconstrictor responses in the toes were aroused by cutaneous stimuli when only spinal mechanisms were available. In another subject, again with a spinal lesion causing loss of voluntary control over movement of the legs and of sensation in the lower half of the trunk and legs, the application of a cold object to the front of one thigh resulted in a vasoconstrictor response limited to the vessels of the toe of the same side: if the area of stimulus was increased, then vasoconstriction appeared in the toes on both sides but never in those of the fingers (see fig. 1). In a third subject, with a vascular lesion at the level of the sixth thoracic segment, pin-prick above the level of the nipple resulted in vasoconstriction of the vessels of the fingers and no response in the vessels of the toes; when applied to the lower abdomen, pin-prick caused only a response in the vessels of the toes; however, when the stimulus was applied to a narrow zone above and below the upper level of maximum sensory loss in the trunk, vasoconstrictor responses occurred in the vessels of both the toes and fingers. This last observation is explicable on the assumption that, owing to the considerable overlap of sensory dermatomes on the trunk, the vasomotor centres in the cord, both above and below the level of the lesion, had received afferent impulses sufficient to initiate the mechanisms responsible for vasoconstriction in the digital vessels of both the upper and lower limbs.

### 4. Responses in Opposite Limb and in Veins

As in subjects with transverse lesions of the spinal cord it is possible to obtain responses in the vessels of the toes on the side stimulated, Elithorn and Crosskey have attempted to determine if in healthy subjects, following graded sensory stimuli, greater vasoconstrictor responses are obtainable in the limb stimulated than in the opposite limb. In a personal communication they have given information which shows that it is possible to obtain greater sudomotor responses in the arm stimulated. Using chiefly pain provoked by deep pressure, they noted that the skin resistance always altered more on the side stimulated. And as with vasoconstriction provoked reflexly by a painful stimulus a fall in skin resistance takes place at the same time, it is fair to deduce that, if the skin resistance alters more in the limb stimulated, the blood-vessels probably constrict more in that limb than in the opposite one. Absolute evidence of this, however, must await further investigation.

FIG. 1. PLETHYSMOGRAPH RECORD IN PARAPLEGIC SUBJECT



R.T.1 and L.T.1 refer to large toe of right and left foot respectively, R.F.3 refers to middle finger of right hand. Arrows point in direction of increase in volume. In A, at signal (S), pin-prick was applied to forehead, with resulting diminution in volume of finger only. In B, pin-prick was applied to right thigh, with diminution in right big toe volume only. In C, multiple pin-pricks to right thigh resulted in greater diminution in volume of right toe and also diminution in volume of left toe.

The observations recounted have been concerned with diminution in volume of a finger following a sensory stimulus. Wilkins, Doupe & Newman (1938) made a study of the changes in blood-flow associated with these changes and concluded that during the stage at which the finger diminished in volume there was a marked decrease in blood-flow to the fingers. Quite rightly then, these responses have been termed vasoconstrictor, and from the flow experiments it is apparent that the constriction at least takes place on the arterial side of the vascular tree. The literature contains few references to responses in veins to sensory stimuli. Doupe, Krynanuw & Snodgrass (1938) demonstrated clearly that in an isolated segment of a subcutaneous wrist vein the tension within the segment increased following a cold stimulus applied to another part of the body, and they interpreted this as favouring nervous control of veins. Lewis & Landis (1930) also observed an increase in the size of veins following sympathectomy. It would thus appear that the veins are in part under the control of the sympathetic nervous system and probably respond in a manner similar to arterial vessels.

##### 5. Vasodilator Function of the Sympathetic Nervous System

The possibility of the sympathetic nervous system having an active dilator function has also been the subject of study. Lewis & Pickering (1931) reported observations which, they

suggested, supported the existence of vasodilator fibres to the vessels of the hands. The interpretation of their results, however, received criticism from Uprus *et al.* (1936). Discussing the response to warming of the body, Grant & Holling (1935) postulated at least two mechanisms: relatively gentle heating resulted in dilatation of the digital arterioles with resulting increased flow to the skin of the hands and feet—this response was believed to be due to release of vasoconstrictor influences and not due to active vasodilatation. If, however, the heating was more intense, causing generalized sweating over the trunk and limbs, there was an increase in temperature of the skin in the proximal portion of the limbs. From the experiments they carried out, they postulated that this increase in skin temperature was the result of active vasodilatation, the product of vasodilator nerves to the vessels of the skin. It is to be noted that their observations were concerned more with skin vessels in the upper arm than with the digital vessels.

##### 6. Conclusions

There is adequate evidence to support the view that, in man, the peripheral sympathetic nervous system contains fibres whose function is to constrict the digital blood-vessels on the arterial side of the vascular bed. This constrictor function is initiated by both visceral and cutaneous sensations. The

reflexes are obtainable at spinal levels; with minimal cutaneous stimuli the reflex is an ipsilateral one, and with greater stimuli bilateral. There is less voluminous evidence that there are fibres whose function is to dilate digital blood-vessels; observations are available demonstrating the presence of

vasodilating fibres to the skin vessels, especially in the proximal zones of the limbs. The veins are also under nervous control which is constrictor; the possibility of vasodilator fibres acting on veins has not been adequately investigated.

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IN this issue of the Bulletin the books reviewed have been classified into a number of main sections which are listed below. It is hoped that this plan will facilitate reference to Part II by specialist readers, and that continuity of interest in the various fields of medicine will be maintained. There are, as before, sections devoted to annotations and news, historical notes, shorter notices, and a guide to the contents of current British medical periodicals.

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## Historical Notes

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## Book Reviews

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tension—Introduction to cardiology—Cardiology—Cardiovascular  
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Wounds of extremities—Static diseases of lower limbs—Varicose veins  
—Ophthalmology, 1949—Joint manipulation—Structure and function  
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### OBSTETRICS & GYNAECOLOGY:

Synopsis of obstetrics and gynaecology—Anatomy of female pelvis—  
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## NEUROLOGY & PSYCHIATRY:

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gence—Psychological aspects of clinical medicine—Physical methods of  
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—Oral vaccines and immunization by other unusual routes—Filterable  
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Bases électrophysiologiques de l'électrocardiographie—Photoelectric  
methods in clinical biochemistry—Iron metabolism—Documenta  
ophthalmologica: advances in ophthalmology—Visual development—  
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Streptomycin.

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fisiología.

## Books Received

## Guide to the Journals



## ANTIBIOTICS

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*Antibiotics*<sup>1</sup>, by the Oxford workers to whom we owe the development of penicillin, has as sub-title "A survey of penicillin, streptomycin, and other antimicrobial substances from fungi, actinomycetes, bacteria, and plants". It is, however, more than a survey and could be described as "All about antibiotics" although, naturally, very recent developments have been too late for inclusion. In spite of this drawback, common to all books on growing subjects, *Antibiotics* surveys all aspects of this subject in sufficient detail to satisfy the requirements of all who want guidance in this branch of chemotherapy. That this is only a branch of chemotherapy can be gathered from the preface where it is stated:

The term antibiotic, which is now in general currency, has been defined by Waksman as a substance produced by one micro-organism which is antagonistic to the growth of others. In this book plant products with antimicrobial properties have been included; these are often referred to in the literature as antibiotics, though strictly speaking it is doubtful whether the term should be applied to them. No consideration has been given to antibacterial substances of animal origin, such as lysozyme, nor to the complex phenomena associated with bacteriophage.

In some ways it is a pity that antibiotics should be arbitrarily separated from other antibacterial substances for, on the one hand, some antibiotics can be synthesized and even produced commercially, as has recently been done with chloromycetin, while on the other, as Florey and his colleagues mention here, their mechanism of action may be similar to that of well-known synthetic drugs. It is therefore quite likely that this distinction will disappear although the study of antibiotics as now defined will continue as a method of finding ready-made antibacterial substances which may turn out, like penicillin, to be useful chemotherapeutic drugs as they are, or may, after the determination of their chemical structure, give a lead to new valuable substances. In any case it is as well that this book is confined to substances produced by living organisms, because it already comprises 1774 pages in these first two volumes, which deal with all aspects except clinical application.

From the general historical introduction it becomes apparent that the bacteriological techniques now in current use for the detection of antibiotics had all been thoroughly exploited many years ago. Most of this work, however, was abortive in that there was little co-operation between the biological worker and the chemist and indeed it is doubtful whether such co-operative work would have been fruitful because many of the biochemical procedures, which are so

essential for the separation and purification of antibiotics, were not then sufficiently developed. In this sense it may be said that the early work on antibiotics was ahead of its time in much the same way as the early experiments which eventually led to the isolation of insulin were frustrated because the methods of blood analysis had not then been sufficiently developed to control their application to man.

That the chemist plays a major role in the hunt for new antibiotics is evident from this book. Taking penicillin alone we find that it requires 13 chapters, comprising 284 pages, to outline its chemical aspects. But though the biologist owes much to the chemist for his help in developing these antibiotics, the chemist too is amply repaid by being introduced to chemical structures that have never before been encountered in nature. Thus the linking of these sciences is paying dividends on both sides—on the one hand increasing the number of new antibacterial substances, of which two, chloromycetin and aureomycin, have recently proved their worth in infections which have been unresponsive to other remedies, and on the other the widening of the range of the chemist's experience.

After the introduction the first volume describes the methods used for the detection and development of antibiotics, and gives details of a large number of these substances from fungi, actinomycetes and plants. The most satisfactory method of detecting antibiotics is the most familiar, namely, sowing the organism to be tested for antibiotic properties on a nutrient agar plate which is also sown with the micro-organism against which antibiotic action is sought. Florey and his colleagues find this a more suitable method than tests made in fluid media. The micro-organisms against which action has been sought have generally been *Staph. pyogenes* and *Bact. coli*, being representative of the gram-positive and gram-negative bacteria, the former of which are usually more sensitive to antibacterial substances. This has been a most useful procedure for screening micro-organisms for antibiotic activity and can also be used for testing extracts of larger organisms such as plants, in which case the extract is placed in a cylinder or in a hole in the agar, so allowing any active substance to diffuse into the medium. With this now classical technique, on the basis of which Sir Alexander Fleming discovered penicillin, much time has been saved in the rapid detection of possibly useful antibacterial substances, active not only against *Staph. pyogenes* and *Bact. coli* but against other micro-organisms. Of these there have now been described at least 80 well-defined antibiotics and many hundreds of active principles. There still, however, remains the possibility that valuable chemotherapeutic substances may be missed by this method, as for example substances like the sulphonamides which, being antagonized by some metabolite present in ordinary media, would not show any effect by cultural methods, but by an interference with some aspect of bacterial metabolism to which animal tissues are indifferent might prove to be of great therapeutic value.

The second volume, which comprises 1144 pages including appendix (65 pages), bibliography (84 pages), indexes (112 pages) to vols. I and II, deals with penicillin and streptomycin and has two final chapters, one on the action of antibiotics on bacteria and another giving conclusions. In the historical introduction to penicillin, Sir Alexander Fleming's discovery of penicillin is fully described and then there is a full account of the early work at Oxford which, owing to the Second World War, was greatly hampered by many difficulties, particularly as regards supplies of essential equipment.

<sup>1</sup> For particulars, see p. 394.

Though little is said here it is obvious that this must have been a heart-breaking time for Florey and his colleagues, who knew that they had a preparation which would revolutionize the treatment of infections, particularly in war wounds, and were not able to get on fast enough because of war-time restrictions. The later development of penicillin and its dramatic effect in clinical practice both in the battlefields and in the civilian population are now so well known and recognized that there is no need to say more here. It is, however, noticeable that the Oxford team do not claim for penicillin all the credit for the dramatic improvements in the surgical treatment of war wounds; they say:

Much of the success attending the use of penicillin for the treatment of the wounded is to be attributed to the increasingly high quality of war surgery, and this again received a great stimulus because surgeons armed with penicillin could, if their technique were sufficiently good, suture even the most severe wounds without the danger of spreading sepsis, and with great benefit to the patient.

In the light of their intense research on antibiotics and their application, the Oxford workers have formulated the properties desirable in a chemotherapeutic agent for systemic use. The agent should have little toxicity to the animal body in comparison with its toxicity to sensitive micro-organisms. It should be active in low concentrations for otherwise the doses would be impracticably high. It should be active in the presence of normal and pathological body fluids and should not be inactivated by tissue enzymes. It should not be anti-

genic because of the great danger of producing allergic phenomena. For most purposes it should be significantly soluble at the pH of body fluids. A great advantage in an antibiotic would be stability sufficient to allow of its administration by mouth.

So far penicillin, with the one single disadvantage of not being usefully administrable by mouth, is the exceptional antibiotic that fulfils these criteria, but recently chloromycetin and aureomycin, two antibiotics that can be given by mouth, have shown exceptional activity against a number of infections. How these new substances will compare with penicillin in clinical practice has yet to be seen. There is, however, no doubt that penicillin has come to stay and will be our main weapon in combating infections when properly used. The other antibiotics will have their place in supplementing penicillin in the treatment of infections in which penicillin is less applicable.

This book will be essential to all those who are interested in chemotherapy and should have a place in every hospital library and medical laboratory. All other works of a similar nature in this field fall far short of this reference book; and it is more than an exhaustive review because of the high standing of the authors who, beside their work on penicillin, have themselves isolated and studied many new antibiotic substances. Their critical evaluation of the subject will therefore command universal respect, and indeed we owe these busy workers a tremendous debt of gratitude for sparing their time to give us the benefit of their unique experience.

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# Annotations & News

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## MEDICAL CONGRESSES 1950

**Autonomic Nervous System.** The Austrian Medical Conference will be held in Salzburg from 7-9 September, 1950. The main subject of the Conference will be "The Autonomic Nervous System and its Influence upon the Course of Illness". Enquiries should be sent to the Sekretariat der Van Swietengesellschaft, Landesskrankenhaus, Salzburg.

**Cancer.** The Fifth International Congress on Cancer will be held in Paris at the Sorbonne, from 15-22 July, 1950. The Congress will coincide with the 50th anniversary of the discovery of radium by Pierre and Marie Curie, to the celebration of which members of the Congress are invited. Papers to be read will deal with the following branches of the subject: biology and experiment, pathology, clinical approach, therapy, social implications of the fight against cancer. Full details may be obtained from l'Union Internationale contre le Cancer, 6 Avenue Marceau, Paris VIII.

**Comparative Fertility.** The new Society for the Study of Comparative Fertility will hold its inaugural meeting at a conference to be held at the premises of the Zoological Society of London on 16-17 June, 1950. Further particulars may be obtained from Dr G. I. M. Swyer, Obstetric Hospital, University College Hospital, London, W.C.1.

**Diseases of the Chest.** The First International Congress on Diseases of the Chest will be held in Rome from 17-20 September, 1950. The Congress is to be held under the auspices of the council on international affairs of the American College of Chest Physicians and the Carlo Forlanini Institute. Further information may be obtained from Professor A. Omodei Zorini, Carlo Forlanini Institute, Rome, or from Dr Chevalier L. Jackson, 500 North Dearborn Street, Chicago 10, Illinois, USA.

**Haematology.** The International Society of Haematology will hold a Congress from 21-26 August, 1950, in Cambridge. The provisional programme includes the following subjects: (i) Therapy of Anaemias; (ii) Hyperpleurism; (iii) Leukaemia, Including Therapy of Leukaemia; (iv) Physiology and Pathology of Coagulation and (v) Immunohaematology. Further information may be obtained from Dr Martin Hynes, Department of Medicine, University of Cambridge.

**History of Medicine.** The Sixteenth Congress of l'Union Internationale d'Histoire de la Médecine will form part of the Sixth International Congress on the History of Science. This will be held in Amsterdam from 14-20 August, 1950. Further information may be obtained from Professor Ir R. J. Forbes, Haringvlietstraat 1, Amsterdam-Z, the Netherlands.

**Maternity and Child Welfare.** The Annual Conference of the National Association for Maternity and Child Welfare will be held in London from 28-30 June, 1950. The theme of the Conference will be "The Child and its Environment" and introductory papers by experts in the field will be followed by group discussions. Further information may be obtained from the Honorary Secretary, National Association for Maternity and Child Welfare, 5 Tavistock Place, London, W.C.1.

**Medical Photography.** An International Exhibition of Medical Photography will be held in London from 12-24 June, 1950, by the Medical Group of the Royal Photographic Society. It is hoped that medical photographers from all parts of the world will submit their work for selection. Entry forms may be obtained from the Honorary Secretary, Kenneth G. Moreman, 16 Princes Gate, London, S.W.7.

**Psychiatry.** The International Congress of Psychiatry will be held in Paris from 18-27 September, 1950, and will include an exhibition of psychopathological art. The secretary-general of the Congress is Dr Henri Ey, 1 Rue Cabanis, Paris XIV.

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## GALEN AND RHAZES: A SPANISH TRANSLATION

The last twenty years have seen the growth of a widespread interest in the history of medicine in most of the countries of Latin America. It is by no means the interest of the dilettante, but a genuine scholarly discipline fostered and maintained by numerous university chairs in the subject and a number of flourishing specialist institutes. The Institute of the History of Medicine of the University of Buenos Aires has long been known for its journal, the *Publicaciones*, which is distributed throughout the world. Formerly edited by Professor Juan Ramon Beltran, it is now under the able direction of his successor in the chair, Professor Anibal Ruiz Moreno. Volume 12,<sup>1</sup> for the year 1948, was published a few months ago and has recently arrived in this country.

The first part of this volume is a most important contribution to Galenic literature, for it is devoted entirely to a Spanish translation of two of Galen's treatises on the pulse. Working in collaboration with the distinguished Spanish philologist Dr Antonio Tovar, Professor Moreno has based his version on Kühn's edition which, if not perfect from a philological standpoint, is the best available, since Galen's writings on the pulse have not yet found their way into the modern critical edition of his works which began in the *Corpus medicorum graecorum* in 1914. There is no complete translation of Galen's works into any modern language, and Professor Singer's appeal for a complete English translation has not shown any obvious results, although I believe that such an undertaking has been started in the United States of America.

Galen wrote seven distinct treatises on the pulse, viz., (i) *De usu pulsuum*; (ii) *De pulsibus od tirones*; (iii) *De pulsuum differentis libri IV*; (iv) *De dignoscendis pulsibus libri IV*; (v) *De consis pulsuum libri IV*; (vi) *De praesagitione pulsibus libri IV*; (vii) *Synopsis librorum suorum de pulsibus*. These were published in their entirety in the *Opera de pulsibus* in 1532, but the only modern work on any of them is Johann Gossen's critical discussion of the *Synopsis* (Berlin, 1907).

It is clear then that Professor Moreno, in undertaking the translation into Spanish of all seven treatises, has found a neglected corner in the field of Galenic studies, and one which is most important for the influence and strength of the Galenic tradition, so that his work will be of value to scholars not only in the Spanish-speaking countries but throughout the world.

He has wisely chosen to begin the series with (ii), the compendium on the pulse for students, a short tract of only twelve chapters, and to proceed to (iii) the four books on the differences of pulses. The chapter headings throughout are taken from the sixth Giunta edition (Venice, 1586); footnotes are sparse, but there is an excellent index of subjects, an index of authors cited in the text, and another of references to Galen's other works. A most useful feature is the glossary of technical terms used by Galen, with their modern Spanish equivalents.

To judge the translation itself one would need to be expert not only in Greek and Spanish philology but also in Galenic physiology and medicine; for those who do not possess this rare combination of attainments the authority and reputation of the two translators is sufficient recommendation.

The second part of the volume under discussion is also devoted almost entirely to the Spanish translation of a classic text, the book on smallpox and measles by Rhazes. The indefatigable Professor Moreno is entirely responsible for this version. As he confesses in his preface, there is no Spanish orientalist with sufficient knowledge of medicine to undertake a direct translation from the Arabic text, and he decided to make a Spanish version of the English translation by W. A. Greenhill which was published by the Sydenham Society in 1848. He could not have made a better choice, and it must be of particular pleasure to English historians of medicine to find the work of one of their greatest predecessors reappearing in this guise more than a century after it was written.

Rhazes' work on the smallpox and measles is too well known to warrant any detailed account here. It is of course the first classic account of both diseases, and for nearly a thousand years there have been few writers on the subject who have not been indebted to it or referred to it in some way or other. The present text is preceded by a useful introduction on the author's life and work.

<sup>1</sup> For particulars, see p. 394.

Concluding the volume is an interesting account of the organization of military hygiene in the Brazilian war of 1827. Written by Professor Moreno in collaboration with Vicente A. Risolla and Rómulo D'Onofrio, this paper was read at the seventh National Medical Congress.

After perusing this very impressive volume I cannot resist the temptation to revive the perennial complaint of the singular lack of a scholarly British journal devoted to the history of medicine. With some of the finest medical libraries in the world and a wealth of material for study, we are still without one; nor is there in any of our universities an institute or even a chair in medical history. The superiority of North America in this respect is already acknowledged. The astonishing activity in South America since 1939, of which this volume is one further proof, should do something to stimulate the responsible authorities in Great Britain.

F. N. L. Poynter

1542

## JOURNALS NEWLY RECEIVED

The *Bulletin of the Hong Kong Chinese Medical Association* entered its second year of publication with the first number to reach us (vol. 2, no. 1, April 1949). The Editorial Board at that time felt assured of its continuance "... as a medium of communication and information for the medical fraternity in Hong Kong as well as a means of union among the members of our Association," and invited contributions, which should be addressed to the Editor-in-Chief, Dr H. C. Chan, Bank of Canton Building, 4th Floor, Hong Kong. The editorial discusses the question of administration of intravenous injections by nurses, which had been raised in the correspondence columns of the previous number, and requests the co-operation of the Association's members in the current anti-tuberculosis campaign. Original articles and case reports are published, and a few abstracts. The Association's annual report is incorporated in the *Bulletin*, and refers to the "very good medical films" which had been shown to the Association by the British Council during the period under review.

*Archivos Argentinos de Reumatología* (Buenos Aires) has published as part of vol. 11, 1949, a special number on the histopathology and pathogenesis of acute rheumatic disease (Bouillaud's disease). The number consists of a monograph by Dr Pedro I. Elizalde, professor of pathological anatomy and physiology in the National University, Buenos Aires. Typical rheumatic lesions of the cardiovascular system, lungs, liver, kidneys, thyroids and thymus, muscular system, tendons and skin are described, each section being illustrated with photomicrographs. The author comments on the high incidence of tonsillar infection and concludes that this is the most frequent cause of acute rheumatic disease.

Vol. 12, no. 2, of the same journal contains two articles on rheumatic disease and allergy, one on climate and rheumatism and a summary of the proceedings of the Seventh International Congress on Rheumatism which took place in New York in May-June 1949.

We have recently received vol. 14, no. 1, 1949, of the *Revista de Instituto Bacteriológico Malbrán* (Buenos Aires). This number consists of 33 reports of original work by members of the institute's staff. Subjects to which groups of four or more studies are devoted are influenza virus "A", *Coccidioides immitis* Rixford et Gilchrist, and *Leptospira*. The number is illustrated with drawings and with nearly 50 photomicrographs of a good standard.

From the Department of Parasitology, University of Chile, we have received two numbers, vol. 4, no. 1 and no. 2, 1949, of the *Boletín de Informaciones Parasitarias Chilenas*. Each number contains three original short articles, an abstract of an important paper on a relevant subject, and a section of news.

The Department of Parasitology and the School of Medicine of the University of Chile have been completely destroyed by fire, and the head of the Department, Professor Amador Neghme, appeals for assistance in re-equipping the laboratories. Publications concerning amoebiasis, trichinosis, trypanosomiasis, yellow fever and hydatid disease are urgently required, and papers dealing with

parasitology, biology, epidemiology, and public health in general, would be appreciated.

The introduction during the summer of 1949 of a limited scheme of BCG vaccination in Great Britain lends interest to a recent special number of the *Boletín Médico Social* (Santiago de Chile), organ of the Caja de Seguro Obligatorio (department of compulsory national insurance). In a covering letter, Dr Alfredo Biondi E., director of medical services in that department, refers to the slow economic development of Chile and its depressing effect on the general standard of living, and notes that "The mortality rate of tuberculosis does not seem to have decreased in the last fifty years (240 per 100,000 inhabitants)."

To break into this discouraging situation the Caja de Seguro Obligatorio launched a national propaganda campaign in favour of BCG vaccination. The campaign had the support of the medical profession, voluntary bodies and other government departments, and was followed by practical measures which it is hoped soon to co-ordinate into a national scheme. No. 164-168 of the *Boletín Médico Social*, May-September 1948, is issued in association with the campaign. Besides three articles by Chilean workers discussing national and local aspects of BCG vaccination, it contains ten others selected and translated from European and American literature; among these are two by Dr Arvid Wallgren, the Swedish pioneer in this field, and one by Dr C. Guérin. A third section includes a detailed history of BCG vaccination in Chile from 1925 to 1948, a group of official documents relating to the campaign, and correspondence on the subject taken from the *British Medical Journal*. The number is illustrated, and English summaries are appended to many of the main articles.

*Minerva Chirurgica* (Turin), another member of the famous group, published fortnightly, is now in its fourth year. Vol. 4, no. 17, September 1949, contains articles on conditions associated with the right half of the abdomen (Professor G. Peracchia), pharyngo-oesophageal diverticula (P. L. Bruzzone), treatment of secondary haemorrhages (Dr M. Pittoni), a case of intestinal occlusion from ascariasis (Dr M. Romano), and Breitman's test for autonomic nervous function in postoperative and post-traumatic states (C. Scartozzi & G. Martinetto). A section of abstracts from current literature completes the issue.

The group of medical journals published by Edizioni Minerva Medica is further enlarged by the appearance of *Minerva Ginecologica* (Turin), vol. 1, no. 1, October 1949. This journal succeeds *Folia Gynaecologica* and *La Ginecologia*, the history of which is outlined in the introduction. Original articles include two on pneumo-amniography (Drs G. Vecchiatti and E. Robecchi), one on surgical treatment of retroflexion of the uterus by the Acconci method (Dr M. Repetti), and one on sympathectomy in painful pelvic syndromes (Dr G. Passera). There is also a section of abstracts from literature, a guide to journals of obstetrics and gynaecology, notes and news, and a section of "Varia" touching on medical aspects of history and art. Summaries in French, English and German of the original articles are grouped together at the end of the journal.

We have received two further volumes in the series *Colección Española de Monografías Médicas*, published by Ediciones BYP of Barcelona, under the direction of Dr J. Puig Sureda. Each of these volumes is a double number: the first (1949, no. 99-100), *Bronquitis crónicas*, is by Dr D. Antonio Marcos Barbero; the second (1949, no. 101-102), *Osteoperiostitis*, is by Dr D. V. Bosch Olives. As is usual in this series, each volume includes, in addition to the main monograph, a section of short original articles on a number of subjects under the heading: "Practical notes on diagnosis and treatment."

The Sociedad de Medicina del Deporte y del Trabajo and kindred organizations in Argentina celebrated the first national congress of industrial medicine in Buenos Aires in May 1948. Its proceedings were published in two volumes, separately paged, during 1949. More than 50 contributions are included, representing nutrition, physiology, legislation, vocational guidance, accident prevention, industrial diseases and toxicology, history of industrial medicine,

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# Historical Notes

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## THE ROYAL COLLEGE OF SURGEONS OF ENGLAND 1800-1950

A century and a half is not a long history for an English institution. Yet, though the Royal College of Surgeons of England, younger than its sister colleges in Edinburgh and Dublin, is this year celebrating only the third jubilee of its charter of incorporation, it is the direct successor of guilds and companies of London surgeons whose lineal ancestry may be traced back without a gap for more than five hundred years.

Towards the end of the eighteenth century the Company of Surgeons was neglecting its business. It had separated from the Barber-Surgeons, with high hopes for independent success, in 1745. But after half-a-century it became legally necessary to make a fresh start. The reformers decided to begin on new lines and, instead of renewing the Company, founded under Royal Charter the College which is now looking back over 150 years of good work. And now the College has re-equipped itself in the most recent years to play an ever more active and useful part in the medical world of the future.

The new College of 1800 inherited from its predecessor a house, 41 Lincoln's Inn Fields, to which the Company had intended to move from its Hall in the Old Bailey its records and such plate and pictures as had been collected since 1745, and, above all, John Hunter's museum, the charge of which had been entrusted to the Company by Parliament. Hunter, the greatest biologist and surgeon of his day, had died in 1793, but the museum was still in his executors' hands. The College also inherited the duties of arranging anatomy lectures, and of examining candidates for the practice of surgery in London and in the national armed Forces. Of these duties the old Company had neglected all but the examining. The new College has developed them immeasurably and undertaken many other important activities. Since the reform of 1843 it has held a truly national position as the Royal College of Surgeons of England, not merely of London as theretofore. Its Fellowship examination instituted at that time is generally recognized as the most honourable surgical examination in Great Britain, if not in the world, and has long attracted aspirants from the distant dominions.

Between 1800 and 1843 the College was very much alive. It had built itself a fine house and museum in 1813, and rebuilt on a more ample scale in 1835 the familiar building, later much extended, but badly damaged in 1941, which is soon to be restored in yet more splendid scope. The Museum had been displayed and developed, and a fine library rapidly collected, both under highly competent officers. But the constitution remained antiquated: all control was in the hands of a self-perpetuating Council, whose members were elected for life from the then small circle of the metropolitan hospital staffs. The good work done by the College could not silence the objectors in the 1830s, when reform was on every man's lips. Fortunately wise opinions prevailed within the Council, and at the instigation of G. J. Guthrie and others, with Benjamin Brodie as the active spirit, a new Charter was obtained in 1843, which established the Fellowship on the basis of an advanced examination

in the surgical sciences. It made the Council elective, reasonably curtailed its privilege and tenure, and as said above made the College a national instead of a local body. So far-sighted was Brodie that no fundamental change in the constitution has been found necessary. Supplementary charters have enabled the College to improve its methods and extend its field of work. A Licence in Dental Surgery was instituted in 1859. In 1883 it joined with the Royal College of Physicians in forming the Conjoint Examining Board to manage the qualifying examination (M.R.C.S., L.R.C.P.); and a number of special diplomas were soon introduced. Women were admitted to full equality within the College in 1926. Since the end of the war in 1945, Faculties of Dental Surgery and of Anaesthetists have been formed. By these reforms the College has grown a hundredfold in membership, and the members are being drawn more than ever into touch with active collegiate life.

Every national institution has a double history. It plays its part, through the distinguished men who give their counsel to its deliberations, in the affairs of the nation. It also has its domestic history in the work of its officials and scientific staff. The College of Surgeons has thus taken a prominent part throughout its history in promoting the education and maintaining the professional standards of surgeons, and in wider medical questions. But of the great surgeons who have filled the presidential chair only a few, such as Brodie or Moynihan or Lord Webb-Johnson, have left a lasting mark on its domestic history. The greatest member of the College Council, Lister, was never President, just as a century earlier John Hunter served on the Court of the old Company but never became Master of it.

The Hunterian Museum was designed by its founder to exhibit on a very extended scale a comparative survey of biological form and function. Hunter seems to have been the first man to conceive of surgery as the application of a knowledge of all living processes to the cure of disease. By the work of Richard Owen, conservator of the museum from 1842 to 1856 and assistant to William Clift for the previous fifteen years, Hunter's collections were reorganized and extended, and fully explained in a series of detailed and illustrated catalogues, which were constructive contributions to the advancing knowledge of physiology and pathology.

One of the conditions under which Parliament entrusted the Hunterian Museum to the care of the College was that Hunterian Lectures should be regularly delivered. Competition to deliver one or more of these lectures, on a topic submitted by the lecturer, has always been keen among rising surgeons of a scientific bent. They have been supplemented by continuous lecture courses and demonstrations of museum specimens given every year by the members of the College's scientific staff. Among these regular courses are the Arris and Gale lectures, delivered under endowments dating back to 1645 and 1507. Since 1946 the College has established an integrated system of postgraduate teaching, and has opened a Residential College in two houses adjoining the central College building. This is only a forerunner of the Nuffield College of Surgical Sciences which will before long rise from the bombed site at the other side of the College. The late war, which did irreparable damage to the Hunterian Museum in the disastrous air-raid of May 1941, provided opportunity for resurgence on an unprecedented scale, which has been seized and exploited by Lord Webb-Johnson, President 1941-49, with masterful foresight. The College has been fortunate in attracting princely endowments for its scientific work, as well as countless donations large and small towards the rebuilding fund, and gifts of specimens for the re-equipment of the museum, not only at home but from overseas.

## ANNOTATIONS AND NEWS

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psychology, hygiene and welfare, absenteeism, women in industry, and evaluation of work. The report is well printed, and illustrated where appropriate.

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The following journals have also been received:

*Acta Societatis Medicorum Upsaliensis* (Stockholm), vol. 55, nos. 1 & 2, 1950

*Aparato Respiratorio y Tuberculosis* (La Paz, Bolivia), year 6, nos. 21-22, 23, 1949

*The Diabetic Journal* (London), vol. 5, no. 12, 1949

*Gaceta Médica de Lima* (Lima), vol. 4, no. 3, 1949

*Les Instantanés Médicaux* (Paris), nos. 1 & 2, 1949 & 1950

*Liječnički Vjesnik* (The Journal of the Medical Association of Croatia) (Zagreb), vol. 71, no. 3, 1949

*Revista de la Federación Médica de Guatemala* (Guatemala), year 3, nos. 14 & 15, 1949

*Szovjet Orvostudományi Beszámoló* (Budapest), vol. 1, no. 1, 1949



Two or three extended periods of great productivity stand out in the College's history in the past 150 years. In the first of these, besides Owen's work in the museum, mentioned already, rapid progress was made in the 1830s in collecting a library which should be a working tool for the College's staff and students, and a real academic storehouse of the records of surgical discovery through the ages. Fifty years later, at the time when periodical publications were beginning to proliferate, the library was thoroughly reorganized. When the College celebrated its centenary in 1900 it possessed one of the finest medical libraries in the country. In the succeeding decades it was outstripped by other libraries of wider scope. But by virtue of its rich resources, early laid down, in surgical classics and basic scientific periodicals it remains one of the premier centres of medical literature in the Commonwealth, and fills an important niche as the specialist library of anatomy and surgery among the many medical libraries which have grown up during the twentieth century. The Council has always encouraged its use by those scientists and students beyond the immediate circle of the College who can produce suitable evidence of their bona fides.

Scientific research has not been neglected. The range of Owen's work in comparative anatomy, in which he included the palaeontological evidence, is still unrivalled. Sir Arthur Keith's epoch-making work in evolutionary anthropology showed what value the insight of genius could derive from the Museum's vast osteological collections, which to others seemed a Golgotha. In more recent years the Buckston Browne Farm and the Bernhard Baron Laboratories, both managed by the College, have contributed to the elucidation of urgent surgical problems: the pioneer work on surgery of the heart by Laurence O'Shaughnessy, a victim of the war, may be quoted. For nearly fifty years the College has been jointly responsible with the Royal College of Physicians for the Imperial Cancer Research Fund, from whose laboratories a series of fundamental *Scientific Reports* has issued. The College itself publishes an *Annual Scientific Report*, and has from time to time issued many publications of scientific value, mostly in connexion with the Museum. Twenty years ago the record of past Fellows was published in *Plarr's lives of the Fellows*, 1843-1930, the work of a former librarian, Victor Plarr. Three years ago the monthly *Annals* of the College were inaugurated, and have already achieved popularity. This journal publishes the scientific lectures delivered at the College, as well as recording current activities and describing historic possessions. By domestic activity no less than by the leading part it plays in the surgical life of the Commonwealth, the College continues to promote, in the words of its Latin motto, "Arts useful to all."

W. R. Le Fanu

1544

## THE DIFFERENTIATION OF FUNCTION OF THE ANTERIOR AND POSTERIOR ROOTS

### Historical Background

When Robert Whytt (1714-1766) became Professor of the Theory and Practice of Medicine at Edinburgh, his old university, in 1747, he busied himself chiefly with physiological experiments, in the course of which he was the first worker to localize a reflex. He obtained lasting dilatation of the pupil by compression of the optic thalamus. Whytt also showed, by experiments on a frog, that an intact portion of the spinal cord suffices for a reflex.<sup>1</sup> Whytt gained prominence in Germany, Switzerland, and France because his theories on neurophysiology brought him into conflict with Albrecht von Haller (1708-1777) of Berne.<sup>2</sup> Fearing, in his history of reflex action, says of Whytt:

Though Descartes is frequently credited with being the originator of the doctrine of reflex action, this is based largely on his chance use of an analogy in support of his theory of the human body as a material machine directed by a rational soul . . . In contrast, Whytt, under involuntary motion, as a result of a penetrating psychological and physiological analysis, recognized a separate class of animal action.<sup>3</sup>

On the clinical side, Whytt is noted as the first to describe tuberculous meningitis.

Another Edinburgh professor, Alexander Monro *secundus* (1733-1817), who described the foramen in the brain, which bears

his name, pointed out that the ganglia of the spinal nerves are formed on the posterior roots and that the anterior roots possess no ganglia:

Instead of this, I have observed, that the posterior fasciculus only of the spinal nerve enters into the ganglion; and that authors have been deceived, by not having slit open the external coat of these nerves.<sup>4</sup>

But as yet there was no appreciation of the true function of the anatomical arrangement.

The first person to insist on the separate functions of the anterior and posterior roots was Alexander Walker (1779-1832),<sup>5</sup> a lecturer in anatomy at the extramural school.<sup>6</sup> He was a brilliant man, though an eccentric; an excellent linguist, his translation of the reports of foreign workers on his own subject (*Documents and dates of modern discoveries in the nervous system*, London, 1839) is unimpeachable.<sup>7</sup> Walker was naturally deeply perturbed when none of his time gave him credit for his speculations. He apparently based his inferences on purely anatomical evidence, however, and unfortunately he made one mistake—he thought the anterior root was sensory and the posterior one motor.

Charles Bell (1774-1842) was the first person to discover that the anterior roots were motor in function. He was the youngest son of an Episcopalian clergyman in Scotland and was devoted to his mother: ". . . for twenty years of my life," he wrote on one occasion, "I had but one wish—to gratify my mother and do something to alleviate what I saw her suffer." After studying medicine in Edinburgh, he took over his brother John's class in anatomy there, but in 1804, to avoid being caught up in the vendetta being waged against his brother by the Professor of Medicine, James Gregory, Charles Bell went to London to seek his fortune. It was, however, in the extramural school at Edinburgh that Bell's attention was first directed to the study of nerves.<sup>8</sup>

Charles Bell had a long way to go before he was knighted for his physiological discoveries, but already he had been not unsuccessful. As a student in Edinburgh he published *A system of dissections*, in two volumes (Mundell, Edinburgh, 1798-1803), illustrated by his own drawings. (It must have been very inconvenient to use on the dissecting table, because it is so large; but then perhaps the idea was to ensure that the student read the relevant section before starting work.) His *Essay on the anatomy and philosophy of expression* (London, 1806) was in after years so to captivate Queen Victoria's interest that she read it with rapt attention for two hours; whilst the Nabob of Arcot had a copy bound in red morocco and satin.

Bell, however, was determined to make a discovery as fundamental as Harvey's on the circulation of the blood. As early as 1807 Bell began to formulate the conceptions which were to bring him fame; and in 1810 he wrote to his brother George:

Next it occurred to me that all the spinal nerves had within the sheath of the spinal marrow two roots—one from the back part, another from before . . .

Experiment 1. I opened the spine and pricked and injured the posterior filaments of the nerves—no motion of the muscles followed. I then touched the anterior division—immediately the parts were convulsed.

Experiment 2. I now destroyed the posterior part of the spinal marrow by the point of a needle—no convulsive movement followed. I injured the anterior part, and the animal was convulsed.<sup>9</sup>

When Bell married in 1811 the young bride soon found that research on nerve function "was the important object of his life", and she tried to understand what he talked about. In this year Bell printed privately his *Idea of a new anatomy of the brain; submitted for the observations of his friends* (Strahan & Preston, London, 1811). Here he referred to the results obtained in the experiments described the year before in his letter to his brother. This pamphlet has been reproduced in full in *Medical Classics* (1936, 1, 105) and fairly fully in J. F. Fulton's *Selected readings in the history of physiology*.<sup>10</sup> The copy in the Library of the Royal College of Surgeons of England has a list of the persons to whom Bell sent his essay, copied from a list in Bell's own handwriting. This shows that he presented copies to John Abernethy, Matthew Baillie, Sir Astley Cooper, Dr. Burrowe of Philadelphia, and others. A transcript of a letter from the printers, also annexed to this copy, establishes that Bell had 100 copies printed at the end of August 1811. It is clear from the *Idea* that at this time Bell still adhered to the old doctrine of the "sensibility" and "insensibility" of nerves.

Since 1822, when Magendie first put forward his claim, there has been controversy as to whether he or Bell deserve credit for the discovery of the functions of the anterior and posterior roots. Béclard, a fellow countryman of Magendie, openly declared in 1884

that there was no doubt that Bell was the first to settle this question by experiment.<sup>8</sup> A more recent writer, Dr J. F. Fulton, however, states:

Though one hesitates to pass judgement upon claims of priority, one cannot doubt that Bell was dishonest and that the chief credit for elucidating the function of the posterior as well as the anterior roots belongs to Magendie. It will be observed that he had clearly in mind the principle of specific nerve energies.<sup>9</sup>

This judgement may be considered harsh. It does appear that Bell's experiments in 1810, published in 1811, were the first, and that they did provide an anatomical basis which had previously not been complete. Certain it is that they inspired Magendie's work. In 1821 Bell's assistant and brother-in-law John Shaw (1792-1827), before his teacher's fame had reached its height there, demonstrated some of the experiments in Paris.<sup>9</sup> In the following year the publication there of the results of Magendie's experiments on a litter of eight puppies<sup>10</sup> proved conclusively that the anterior roots are motor and the posterior ones sensory; this was further confirmed in the frog by Johannes Müller (1831), in the fish by Wagner (1846) and Stannius (1849), and in birds by Panizza (1834) and Schiff (1858).<sup>11</sup> The fundamental law of neurophysiology which states that a nerve fibre cannot be both motor and sensory should, perhaps, be called the Bell-Magendie Law.

In connexion with the controversy, it may be of interest to quote two Orations. One was delivered in 1843 by James Moncrieff Arnott; the other in 1935, by Professor Edwin Bramwell. Dr Arnott said:

There remains to Bell clearly and unequivocally the merit of having first shown that in investigating the functions of the nervous system, we must first direct our attention to the roots and not to the trunks of nerves. That the nervous trunks conveying motion and sensation consist of two distinct sets of filaments in the same sheath. That the filaments for motion form a distinct root from those of sensation; leaving it to be inferred that the posterior are for sensation . . . And lastly, of having been the first who, dissatisfied with the observation and study of the mere form of the various parts of the nervous system, applied the method of experiment to aid him in determining their function.<sup>12</sup>

In the words of Professor Bramwell he

. . . formulated a working conception of the nervous system when all was in a state of chaos, a conception which stands today and has served as a basis for all subsequent inquiry and progress.<sup>13</sup>

In 1833 Marshall Hall (1790-1857) introduced the conception of the spinal cord as a chain of segments whose functional units are separate reflex arcs. Marshall Hall's demonstrations of tonic closure of the sphincters by reflex action, of cessation of strychnine convulsions after destruction of the spinal cord, and of the fact that most reflexes are more readily elicited by stimulating the appropriate end-organs rather than their trunks, although appreciated abroad, were for a time the subject of bitter controversy in Britain.<sup>5</sup>

Sir Charles Bell always retained his early love for drawing and painting, in which he had great skill, as shown in his first book on dissections. Paintings which he made of war wounds at Waterloo hang in the Museum of the Royal College of Surgeons of Edinburgh. In 1842, while on a sketching holiday in Worcestershire, Bell died suddenly during the night. He was buried in the village churchyard at Hallow Park.

Alexander Walker had died ten years previously, still convinced that the anterior root was sensory and the posterior one motor.

Laurence Dapson

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#### PAUL EHRLICH

Dr Johnson straddles English literature partly because he was fortunate enough to have the perfect biographer; in this respect Paul Ehrlich was also fortunate. When he declared to his friends that for successful work there must be four "G's"—*Geduld, Geschick, Geld und Glück* (patience, ability, money and luck)—Dr Meyer, one of his assistants, replied: "If the first three are present and used properly the fourth 'G' comes by itself". The truth of Dr Meyer's reply will be evident to the reader of Martha Marquardt's book.<sup>1</sup> By his faithful use of the first three "G's" Paul Ehrlich created for himself the fourth "G"; he provided Martha Marquardt with the opportunity to watch, to work, and to worship, and out of that association has grown a biography which is almost Boswellian in its faithful detail.

#### PAUL EHRLICH 1854-1915



Acknowledgements to William Heinemann Medical Books Ltd.

To the world at large, Ehrlich is simply the man who discovered salvarsan (606), a cure for syphilis. His claim to fame as a scientist goes much deeper. True, he discovered a number of useful remedies, but so have others whose names are now almost forgotten. Paul Ehrlich was the leader, almost the crusader, in a new branch of medical science which has added to the armamentarium of the practitioner many drugs which are now almost taken for granted as a natural heritage of man. Indeed, looking back to the decades before Ehrlich published his first papers, one wonders what the practitioners did beyond awaiting the natural outcome of a disease; take away serum therapy, arsenicals, antimonials, basic dyes, alkaloids, sulphonamides and antibiotics, and what is left?—a bare medical chest, indeed, for the treatment of microbial infections.

Ehrlich's theories on the mode of action of antibodies and drugs were attacked during his own time, and since, on the grounds that they were too naive or too pictorial; but it is evident from his own writings, and even more clear from Miss Marquardt's book, that he was endowed with more than an ordinary capacity for visualization of his problems. Although this tempted him to explain his theories in highly pictorial terms, it was also this characteristic which enabled him to direct research in the complex field of organic chemistry and to wed it so successfully to biological research.

<sup>1</sup> For particulars, see p. 394.

The fundamental problem which faces the student of chemotherapy today is selective toxicity. Why is penicillin or chloromycetin able to destroy infecting micro-organisms without showing any appreciable toxicity towards the host cells? We find the problem stated by Ehrlich in somewhat different terms: "It is quite evident that only those substances in which the organotropism and parasitotropism stand in a well-balanced relation to each other can be used in practical medicine as curative substances." It is easy to imagine how excited Ehrlich would have been over the recent discoveries in intermediary metabolisms and comparative biochemistry which begin at last to provide a clue that may solve the riddle.

Interwoven with the picture of Ehrlich the scientist is the picture of Ehrlich the man, and how vivid a picture Miss Marquardt has achieved! She has presented to us an autocrat, intolerant of criticism; a man of childlike simplicity; a lovable, generous and gentle soul devoted with a passionate singleness of purpose to a cause—the cause of science. It would have been easy for Miss Marquardt to gloss over some of the less likeable characteristics of her "chief" and still to have given us a moving picture of a great man; but instead she had the faith that the weaknesses were as essential to a genuine representation of Paul Ehrlich as the rest, and how right she was! This, we feel, is the true likeness of the man, and in its truth still great.

On one point only do I wish to dispute. On page 176 Miss Marquardt states that "606, like all the other substances previously prepared, was invented by Ehrlich *alone*." The italics are not mine. No scientist works in mental isolation; none of his ideas are due to himself alone, particularly when these ideas are worked over by a team such as that which Ehrlich led; and yet after reading this book one wonders, might not Paul Ehrlich himself have made such a claim?

Sir Henry Dale has written a valuable introduction, and while Miss Marquardt makes no attempt to deal with the scientific aspects of Ehrlich's contribution to medicine, she has admirably succeeded in producing a truly fascinating study of the workings of the mind of a great man.

T. S. Work

1546

## WILLIAM HARVEY

It is safe to say that more has been said and written about William Harvey than about any other great figure in medicine, save only Hippocrates. Many writers have attempted an evaluation of his contributions to science; the effect of his discovery of the circulation of the blood has been fully studied. The comparatively little material available on the personality of Harvey has now been augmented by Mr Geoffrey Keynes, who has devoted his Linacre Lecture<sup>1</sup> to this subject. Mr Keynes has briefly but skillfully outlined Harvey's career and has at the same time attempted to re-discover his personality by a critical examination of the several portraits in existence, the opinions of Harvey's contemporaries, and the words and acts of the man himself. In discussing the iconography of Harvey, Mr Keynes speaks with authority, for in his Thomas Vicary Lecture for 1948 he gave a full account of the existing portraits, bringing some order to the confusion that had existed regarding them. The present scholarly work is a fitting complement to it and a small but valuable addition to the vast literature on Harvey.

L. T. M.

<sup>1</sup> For particulars, see p. 394.

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# MEDICINE

## 1547 A Synopsis of Medicine

Henry Letheby Tidy. Ninth edition, revised and enlarged. Bristol: John Wright & Sons Ltd., 1949. xx + 1,243 pages. 19 x 13 cm. £1 10s. [£1.5]

(i) Specific infectious diseases; (ii) diseases due to physical agents; (iii) the intoxications; (iv) diseases of metabolism; (v) diseases of deficiency; (vi) diseases of the digestive system; (vii) diseases of the circulatory system; (viii) diseases of the respiratory system; (ix) diseases of the kidney and urinary tract; (x) diseases of the blood and spleen; (xi) diseases of the endocrine glands; (xii) diseases of the muscles, joints, and bones; (xiii) diseases of the nervous system. Index.

Of the many synopses available to the English-speaking medical student or postgraduate, "Tidy" holds pride of place. That it does so is due to the fact that it almost certainly contains within its covers more information than any other single-volume textbook of internal medicine. To criticize the new edition seems like sacrilege, but there are a few points which appear to merit discussion. On the diagnostic side, there is indeed little to quibble about. The clinical descriptions of disease are nearly always adequate and often encyclopaedic. The classification is beyond reproach. But it is otherwise with the sections on treatment. The author occasionally enters into the general conspiracy of writers of textbooks on internal medicine to conceal many useful points in modern therapy from the student. Thus, he does not mention surgery for hypertension or for portal cirrhosis; pneumoperitoneum for pulmonary tuberculosis, theophylline in status asthmaticus, and sulphamide prophylaxis of acute rheumatism are also passed over in silence. The statement that colectomy is contra-indicated in Hirschsprung's disease is diametrically opposed to Aird's experience. One has the impression that colchicine is more frequently used for gout than the older tincture of colchicum, and that phenobarbitone should be mentioned before the bromides in epilepsy. It is not sufficiently emphasized that in thrombo-angiitis obliterans the first thing to do is to stop the patient's smoking. No mention is made of the distinction between granuloma inguinale and lymphogranuloma venereum.

We are sorry to see that the London Hospital work on type I and type II nephritis is ignored, as is the concept of high-output and low-output cardiac failure. Errors are of course very few. We note "Hering-Breuer" for "Hering-Breuer" on p. 643 and "Harrington" for "Harrington" on p. 920.

In conclusion, the reviewer must confess that he has bought the last five editions of this book, which he regards as unrivalled for rapid reference.

S. S. B. Gilder

## 1548 The British Encyclopaedia of Medical Practice, Including Medicine, Surgery, Obstetrics, Gynaecology and Other Special Subjects. Medical Progress 1948

Edited by Horder. London: Butterworth & Co. Ltd. [1948] v + 511 + 28 pages; 5 figures. 25 x 17 cm. £1 10s. [£1.5]

Part I. Critical surveys. (i) Medicine; (ii) surgery; (iii) obstetrics and gynaecology; (iv) paediatrics; (v) cardiology; (vi) chest diseases; (vii) acute infectious diseases; (viii) aviation medicine; (ix) industrial medicine; (x) forensic medicine; (xi) psychological medicine; (xii) tropical medicine; (xiii) chemical pathology; (xiv) progress in vitamins. Part II. Drugs. (xv) Recent developments in pharmacology and therapeutics. Part III. Abstracts. (xvi) Abdominal pain and acute abdominal emergencies—yaws. Index.

For those to whom this annual favourite is unknown, it may be said that it is designed to supplement the information in the encyclopaedia which appeared just before the war. The record of progress is divided into three parts: a series of critical surveys of the most interesting topics of the year, a short section on new drugs, and a selection of abstracts of important articles which have appeared within the previous 12 months. In the present volume, a survey of the abstracting section suggests that no important paper has been overlooked. In the critical surveys, emphasis is on clinical work, and practically every section holds something of interest to the keen general practitioner. Special mention may be made of the brief but informative sections on medical and surgical aspects of hypertension and peptic ulcer, while the physician, surgeon and obstetrician all discuss the problems of thrombosis,

with reference to anticoagulant therapy. The sections on paediatrics and cardiology should be of great interest to all clinicians. There is a good discussion of salient advances in aviation medicine since 1941, and an article on forensic medicine in which the writer has wisely not attempted to cover recent literature, but has filled the space at his disposal with hints for the practitioner suddenly forced into the role of forensic expert *malgré lui*.

S. S. B. Gilder

## 1549 Traité de Médecine. Volumes VIII, X & XI

Edited by A. Lemierre et al. Paris: Masson & Cie, 1948.

Volume VIII: Maladies du foie et du pancréas. 1,166 pages; illustrations. 25 x 17 cm. 2500 fr. Volume X: Maladies du coeur. 1,167 pages; illustrations. 25 x 17 cm. 3600 fr. Volume XI: Maladies des vaisseaux. 545 pages; illustrations. 25 x 17 cm. 1400 fr.

Volume VIII: Maladies du foie. (i) Sémiologie physique du foie, radiologie hépatique; (ii) exploration fonctionnelle du foie. I. Les syndromes hépatiques; (iii) L'insuffisance hépatique; (iv) le syndrome d'hypertension portale; (v) les ictères. II. Maladies hépatiques. (vi) Les foies congestifs; (vii) les cirrhotiques; (viii) la maladie de ; hépatites ; toxiques; (ix) les dégénératives; (xii) ; les parasitaires; (xvi) les abcès du foie; (xvii) les kystes hydatiques du foie; (xviii) les tumeurs du foie; (xix) les affections vasculaires du foie; (xx) la leptospirose à spirochaeta ictero-hémorragique; (xxi) leptospirose grippo-typhosique et canaliculaire. III. Les affections biliaires. (xxii) Moyens d'exploration des voies biliaires; (xxiii) les troubles fonctionnels de la vésicule et des voies biliaires (dyskinésies biliaires); (xxiv) les cholécystites aiguës non lithiasiques; (xxv) les cholécystites chroniques non lithiasiques; (xxvi) la lithiase biliaire; (xxvii) les angiocholites aiguës et chroniques; (xxviii) traitement chirurgical de la lithiase biliaire et de ses complications; (xxix) les cholécystites; (xxx) les cancers des voies biliaires. Maladies du pancréas. (i) Sémiologie du pancréas; (ii) pathologie du pancréas; (iii) indications chirurgicales dans les pancréatites aiguës, chroniques et les tumeurs du pancréas.

Volume X: (i) Examen du cardiaque. I. Sémiologie cardiaque. (ii) Sémiologie cardiaque fonctionnelle et exploration fonctionnelle du coeur; (iii) sémiologie cardiaque clinique; (iv) sémiologie radiologique cardio-vasculaire; (v) la phonocardiographie; (vi) cardiographie et phlébographie en clinique; (vii) électrocardiographie; (viii) troubles du rythme cardiaque. II. Maladies du coeur. (ix) Les cardiopathies congénitales; (x) les cardiopathies acquises; (xi) les endocardites aiguës; (xii) troubles valvulaires chroniques; (xiii) affections du péricarde; (xiv) affections des artères coronaires, les angines de poitrine; (xv) les maladies du myocarde; (xvi) traitement médical des cardiopathies. Les médicaments à action myocardique; (xvii) indications du traitement chirurgical dans les maladies du coeur, du péricarde et des vaisseaux.

Volume XI: (i) Méthodes d'examen et sémiologie vasculaire; (ii) les syndromes d'hypotension artérielle; (iii) l'hypertension artérielle expérimentale; (iv) l'hypertension artérielle. Étude clinique et thérapeutique; (v) traitement chirurgical de l'hypertension artérielle chronique; (vi) les maladies de l'aorte; (vii) maladies de l'artère pulmonaire. Les artérites pulmonaires; (viii) les artérites des membres; (ix) les phlébites des membres; (x) les varices des membres; (xi) les troubles vaso-moteurs et artério-capillaires.

The list of collaborators shows that there are many distinguished contributors to this series and indicates that it has the wide support of French medicine. The printing and production are excellent and the price is much lower than that of similar English and American books. This is a considerable virtue, for no highly priced encyclopaedia is likely to sell nowadays. An encyclopaedia is unavoidably uneven, for the contributors must be numerous, if each is to be expert in his subject; also, it must soon fall out of date, since knowledge advances so rapidly. For these reasons it is tending more and more to be replaced by the review and the monograph.

The only satisfactory way to review an encyclopaedia is to use it for a time as a reference book in one's daily work. When a book is frequently consulted in this way on the actual problems of diagnosis, treatment and teaching, its real value as a tool at the work-bench can be estimated. This test is extremely difficult to apply to the volumes under review because they are not indexed and the tables of contents are not sufficiently informative. This is normal French practice but it seems to be a bad one. Another major difference between this French treatise and Anglo-American literature is the differentiation of variants of diseases as separate syndromes and the preservation of eponyms for these syndromes. If we study any common disease, such as ulcerative colitis or disseminated sclerosis, we find that the course and prognosis vary with such factors as the onset and evolution of symptoms and the particular manifestations. In France there seems to be a tendency to crystallize these different manifestations under special titles, whereas in England we are more impressed by the underlying unity of the disease process. These two factors, the absence of an index and the isolation of unfamiliar

syndromes, make this encyclopaedia difficult reading for an English reviewer.

The difficulties are especially great in volume VIII, which deals with the liver and the pancreas. The opening pages describe methods of examination, including radiology and liver function tests, hepatic insufficiency and portal hypertension. One would have appreciated a more general discussion of the anatomy, physiology and biochemistry of the liver, and its role in health and disease, on lines such as McNee, McMichael and Himsworth have followed in Great Britain. Icterus is described almost entirely in clinical terms and there is repetition of much the same material under icterus and hepatitis. In consequence, newer work, such as the advances in knowledge of haemolytic disease of the new-born and of infective hepatitis, is dismissed too briefly. The recognition of the frequency and importance of "inoculation jaundice" is one of the major discoveries of the last decade, but little is said in this book about the relationship of catarrhal jaundice and infective hepatitis on the one hand and post-arsenical jaundice and serum jaundice on the other, or about the differences in symptoms and severity, the variation in communicability and in infectivity of stools, naso-pharyngeal secretions, etc., or the degree of immunity and cross-immunity conferred. In cirrhosis, it is possible that English and American authors have oversimplified the problem, but no such reproach can be made against this volume, which describes three different varieties of tuberculous cirrhosis, in addition to devoting a chapter to tuberculosis of the liver.

It is a relief to pass on to the later sections, where well-defined pathological entities are clearly described. There is a magnificent account of leptospirosis. In relation to the biliary tracts and the pancreas, there is a full discussion of accessory methods of examination, including not only biliary drainage and cholecystography but also angiography and biliary radiomanometry. It is interesting to compare this whole volume with volume III of Bockus' *Gastro-enterology* (1946). Bockus and his collaborators give a much more up-to-date and succinct account of the liver, whereas there is little to choose between the two in relation to biliary tract and pancreas; in fact, one supplements the other.

Volume X contains an account of heart disease on more or less familiar lines. There are excellent accounts of radiology of the heart, electrocardiography and phonocardiography. Angiography and cardiac catheterization are mentioned incidentally but no full-dress discussion of their effect on modern views on the etiology, diagnosis and treatment of heart failure is given. Volume XI contains only 550 pages as compared with over 1,100 in each of the other two volumes. There are full descriptions of vascular hypotension and hypertension, though unilateral renal disease and suprarenal tumours receive less attention than they deserve. Disease of the peripheral arteries is also perhaps treated more briefly than its growing importance merits. This volume is less fully illustrated than volumes VIII and X; throughout the series, the illustrations are of high quality and the radiographs excellently reproduced.

L. J. Witts

## 1550 Bedside Diagnosis

Charles Mackay Seward. Edinburgh : E. & S. Livingstone Ltd., 1949. xii + 372 pages; illustrations. 19 x 12 cm. 17s. 6d. [£0.875]

(i) Psychogenic symptoms; (ii) some general considerations regarding pain; (iii) head pain; (iv) thoracic pain; (v) epigastric pain; (vi) umbilical pain; (vii) hypogastric pain; (viii) lateral abdominal pain; (ix) anaemia; (x) epistaxis; (xi) haematemesis; (xii) haematuria; (xiii) haemoptysis; (xiv) cough; (xv) dyspnoea; (xvi) tachycardia; (xvii) dysphagia; (xviii) vomiting; (xix) diarrhoea; (xx) jaundice; (xxi) debility and loss of weight; (xxii) pyrexia. Index.

This useful book "was begun in India in 1945 as a distraction from the burden of the day and the heats", and occupied the spare time of the author for the ensuing four years. Its purposes are to help the medical student in his efforts to develop the art of diagnosis, and to assist the practitioner in so organizing his knowledge that he will bring it the more effectively to bear where it is most needed—at the bedside. The carefully considered plan of the book largely succeeds in gaining these objectives. After a brief introduction, short chapters are devoted to psychogenic symptoms and to general considerations regarding pain. Each successive chapter

then deals with a single main complaint or symptom. There is first a synopsis of its possible causes, then a discussion of its physiology and a more detailed consideration of etiology, followed by a discussion of the routine of examination and investigation which should lead to correct diagnosis.

The work underlines the mental processes which should take place in the physician's mind as he considers his case; it serves as a portable guide to differential diagnosis. One can only agree that more mistakes are due to failure to apply knowledge than to ignorance; in helping to guard against such failures the book will have its greatest value. The plan of the book, however, is not without its pitfalls; many diseases must of necessity fall under several chapter headings, and this leads to a plethora of cross-references and an interrupted and repetitive description of the various syndromes. The brevity of the book, a sine qua non of its purpose, exacts its toll of dogmatic statements which perhaps would benefit from qualification. Complaints of the extremities are not dealt with, arthritis is barely mentioned, and the syndrome of the extruded intervertebral disk escapes notice. This is regrettable, in view of the frequency with which the practitioner is confronted with the problem of the differential diagnosis of low back pain.

But these criticisms, after all, are minor; a great deal of useful information has been compressed into small compass, and the book is one to read and use as a practical manual rather than as a work of reference. Certain it is that the practitioner who absorbs and applies its teachings will find his approach to his patients at once more direct and more effective than before; the student will here find the answer to that frequently vexing question, "What should I do, or ask, next?" Dr Seward is to be congratulated on having written a book which should rapidly establish itself as a favourite.

D. F.

## 1551 An Index of Treatment, by Various Writers

Edited by Robert Hutchison, assisted by Reginald Hilton. Thirteenth edition. Bristol: John Wright & Sons Ltd., 1948. xi + 972 pages; 100 figures. 25 x 17 cm. £4 4s. [£4.2]

The object of this 40-year-old favourite is clearly set out in the preface. It is designed to supply the practitioner or general handyman of medicine with sound practical advice on the treatment of any condition—medical, surgical, gynaecological or obstetric—with which he may be confronted. For convenient reference articles are arranged alphabetically; they are contributed by a number of well-known British specialists. The advantage of such a book to the more self-reliant practitioner is clear. Where the contributor considers that an intelligent general practitioner could administer the necessary treatment himself, such treatment is described in detail. Where it is obviously beyond his powers, only the principles of therapy are discussed.

The inevitable drawback to such a book is of course the immense difficulty in editing. This drawback is sometimes evident in the present edition. Some contributors have given an excellent up-to-date account of their subject; others have allowed dead wood to remain. Thus, some drugs, such as iron, quinine and purgatives, appear in circumstances which would surprise the modern pharmacologist. It is difficult to believe that iodides arrest hypertrophy of the breasts, or that small doses of quinine help to clear up Eustachian catarrh. Occasionally, a diet recommended bears little relation to present-day food supplies in Britain. A notable omission is the fenestration operation for otosclerosis, which is surely worthy of notice by the most conservative.

Fortunately, the majority of the articles of importance to the general practitioner are full of sound advice. It is difficult to select for praise, but the reviewer was impressed by those on diabetes, mental deficiency, insomnia, the psychoneuroses and anorexia nervosa; on the surgical side the articles on head injuries, fractures, foreign bodies in the air passages, and, of course, the contributions by Hamilton Bailey and Denis Browne, are of the greatest value.

This work, and its companion volume on differential diagnosis, would go far to equipping an isolated practitioner with the knowledge necessary to his efficiency.

S. S. B. Gilder



## 1552 Early Recognition of Disease

Edited by Heneage Ogilvie & William A. R. Thomson. London: Eyre & Spottiswoode Ltd., 1949. (The Practitioner Handbooks.) 134 pages. 22 × 14 cm. 10s. 6d. [£0.525]

(i) Heart disease; (ii) respiratory disease; (iii) neurological disease; (iv) digestive disorders; (v) diseases of the blood; (vi) renal disease; (vii) endocrine disease; (viii) diseases of the eye; (ix) orthopaedic disabilities; (x) non-specific arthritis in adults; (xi) malignant disease; (xii) mental disorders; (xiii) the complications of pregnancy; (xiv) diseases of childhood. Index.

In the early years of medical practice there is a gradual blurring of the sharp outlines of knowledge acquired before qualification; in too many medical careers, symptoms which elicited an almost automatic diagnostic response in the student and house-physician gradually lose their effectiveness as stimuli. Hard-driven, for the most part, and immersed in everyday routine, the general practitioner of ten or a dozen years' standing can avoid or delay this process only by constant revision; and constant revision of the reasonably well-known is a difficult and unrewarding occupation. There is therefore a need for volumes such as this, which presents the views of 15 authorities in less than 125 pages. Each contributor has written a short essay summarizing the facts which should be in the minds of those who see disease in its early stages.

Crighton Bramwell writes on heart disease; his warnings against attributing symptoms to non-existent cardiac lesions in cases of neurocirculatory asthenia are very much to the point, and his statement that even patients with organic heart disease may develop symptoms on a neurotic basis is apposite. The article on neurological disease, by Macdonald Critchley, analyzes the common signs and symptoms attributable to organic disease of the nervous system in very brief compass, and should be of considerable value. The author makes a useful division of these into groups which do not necessarily, which usually, and which almost always, connote organic disease.

The contributions by John F. Wilkinson, "Diseases of the blood", and by Robert Platt, "Renal disease", should be of considerable assistance in differential diagnosis. Ian Lawson Dick and Sir Reginald Watson-Jones have collaborated to produce a useful short article dealing with the more common types of orthopaedic disability, and H. Gardiner-Hill has written on the early diagnosis of the metabolic group of endocrine diseases. There are nine other articles in the symposium which together cover most of the fields with which the general practitioner is concerned.

There is little room for criticism in the case of authors of such calibre, but one feels that the project has been a trifle ambitious for such a small book. Six pages on diseases of childhood by Professor Alan Moncrieff are well worth reading, but one feels that sixty pages would be more appropriate; it is difficult for even such a master to avoid the trite, and impossible, in such brief compass, to develop points worth expanding. The other articles share this handicap of undue brevity. In spite of this, however, there are few general practitioners who would not benefit from perusing this volume. It has, of course, been produced as a Practitioner Handbook and not in any sense as a work of reference.

D. F.

## 1553 Diseases of Children. Volume II

Edited by Donald Paterson & Alan Moncrieff. Fourth edition. London: Edward Arnold & Co., 1949. vii + 1033 pages; 380 figures. 23 × 15 cm. £2

(i) Organic diseases of the nervous system; (ii) functional disorders of the nervous system; (iii) congenital mental defect in childhood; (iv) diseases of the eyes; (v) diseases of muscles; (vi) diseases of bones and joints; (vii) orthopaedic surgery; (viii) medical diseases of the genito-urinary system; (ix) surgery of the uro-genital system; (x) diseases of the liver, gall bladder and pancreas; (xi) diseases of the peritoneum; (xii) rheumatism; (xiii) diseases of the cardiovascular system; (xiv) blood disorders; (xv) infectious diseases; (xvi) venereal disease; (xvii) diseases of the skin; (xviii) malignant disease in children. Index.

The second volume of Garrod, Batten & Thursfield's *Diseases of children*, edited by Paterson & Moncrieff, includes the work of 24 contributors. Fifteen of these are on the staff of the Hospital for Sick Children, Great Ormond Street, London, so that the book represents the teaching of the London Institute of Child Health.

The two volumes of *Diseases of children* comprise the most up-to-date and detailed British textbook of paediatrics available. Vol. II, like Vol. I, is very well produced on good paper, the print is satisfactory, and the clinical photographs and photomicrographs are excellently reproduced. The x-ray reproductions, however, as is

usually the case, lack definition and detail. The amount of space given to each subject corresponds to its importance: the volume is packed with accurate factual information, and the index is reliable—points of paramount importance in a textbook. From the point of view of the would-be examinee it is regrettable, however, that no clinical photograph could be found to illustrate each of the rarer congenital bone abnormalities mentioned in the text.

Two major criticisms can be made of the book. One is of the references: those given at the end of each chapter are sadly inadequate, often of startling antiquity, and many authors' names, mentioned in the text, are searched for in vain among them.

The second criticism concerns the whole conception of the work. In its present size, it is too detailed for the undergraduate, yet neither text nor references are adequate for a reference book, to be used by the postgraduate student or the specialist. Surely there is room for a really exhaustive, standard British work on paediatrics, to be placed beside the great Continental and American systems.

## 1554 An Epitome of the Laboratory Diagnosis and Treatment of Tropical Diseases

Horace M. Shelley. Second edition. London: Staples Press, 1949. 147 pages; illustrations. 22 × 14 cm. 10s. 6d. [£0.525]

(i) Examination of the blood; (ii) blood diseases in the tropics; (iii) protozoal diseases; (iv) virus diseases; (v) the dysenteries and liver abscess; (vi) bacterial diseases; (vii) nutrition and deficiency diseases; (viii) climatic diseases; (ix) snake poisons and myiasis; (x) miscellaneous diseases; (xi) diseases due to fungi; (xii) diseases due to helminths; (xiii) compendium of drugs; (xiv) laboratory notes. Index.

This book is meant to "supply the busy practitioner of medicine in the tropics with simple details concerning the essentials of laboratory diagnosis and the treatment of diseases common to those climes. All mention of symptomatology and clinical signs is avoided . . ." This unusual combination of pathology and treatment is worked out in 14 very short sections, including those on examination of the blood, blood diseases in the tropics, protozoal diseases, virus diseases (this includes Bartonella infection), the dysenteries and liver abscess, bacterial diseases, nutrition and deficiency diseases, climatic diseases, snake poisons and myiasis (an odd mixture), miscellaneous diseases, diseases due to fungi and diseases due to helminths (in which are included lamblia and balantidiasis!). Laboratory notes include a list of requirements for the establishment of a small laboratory.

Some of the accounts of laboratory procedures are clear and straightforward and may be useful to general practitioners who have to do their own clinical pathological investigations. The rough sketches accompanying certain sections are, however, very crude and serve no useful purpose. The notes on the interpretation of results are sometimes misleading, and there are many points on which the reader may find himself in conflict with the author. For instance, Giemsa or Leishman stains only are recommended for staining blood-films in malaria. Rapid methods of staining now in common use, such as Field's, are referred to in the section on examination of the blood, but not in that on malaria. There is no mention of the importance of serological reactions in the diagnosis of yaws, or of serial serological examination for immune bodies in cases of suspected yellow fever. The details of the cultivation and differentiation of dysenteric bacilli are surely outside the stated scope of the book, quoted in the first sentence of this review. Needling of an amoebic abscess as a method of diagnosis is recommended, apparently without reserve. The inclusion on p. 104 of "Increase of haemoglobin to 110 with polycythaemia" as a pathological feature of "heat stroke" is thoroughly misleading and not accompanied by any explanation or qualification.

The sections on treatment are not always easy to follow, and the advice given may be questioned in places. The author's statement regarding paludrine is quoted: "It is considered superior to all other anti-malarial remedies and a single dose of 100 mg. has proved efficient in stopping clinical attacks of malignant tertian and benign tertian malaria." The dosage of mepacrine recommended for the treatment of the "uncomplicated case of acute malaria" (species unspecified) is lower than that in general use.

In blackwater fever the author recommends that "the patient should imbibe large quantities of fluid . . ." He does not stress the importance of maintaining a fluid balance, and the dangers of excessive fluid intake are not mentioned. Judging by his further recommendations in the treatment of blackwater fever, the author

does not adhere to any of the modern views of its pathogenesis. Twenty grains of sodium bicarbonate given every two hours during the first day (in Sternberg's mixture) "... renders the urine alkaline." Caffeine sodium citrate "can be used as a diuretic." Finally: "Antimalarial remedies should be withheld, for the damage has already been inflicted and at this stage the ordinary remedies are useless." The reviewer disagrees on every count, and believes he is in good company. Alkali will not always render the urine alkaline, particularly when the kidneys are already damaged; ordinary diuretics are of no value; antimalarial drugs other than quinine must be used if parasites are present in the peripheral blood.

B. G. Maegraith

## 1555 Bright's Disease

Henry A. Christian. New York : Oxford University Press ; London : Geoffrey Cumberlege, 1948. (Reprinted from Oxford Loose-Leaf Medicine with the same page numbers as in that work.) vi + 385 + 13 pages ; 40 figures. 24 x 16 cm. £2 5s. [£2.25]

Part I. General considerations. (i) Introduction; (ii) historical; (iii) normal renal structure and function; (iv) protein in urine (albuminuria); (v) casts and cells in the urine; (vi) blood chemistry; (vii) etiology; (viii) pathogenesis of renal lesions of Bright's disease; (ix) pathology; (x) pathological physiology; (xi) method of examining the patient with Bright's disease; (xii) clinical classification. Part II. Clinical aspects. (xiii) Introduction; (xiv) acute Bright's disease; (xv) acute Bright's disease, hemorrhagic type or type without nephrotic syndrome (acute hemorrhagic Bright's disease); (xvi) acute, subacute and chronic edematous Bright's disease, nephrotic type (nephrotic syndrome of Bright's disease); (xvii) subacute and chronic hemorrhagic Bright's disease; (xviii) chronic non-edematous Bright's disease; (xix) certain special syndromes of Bright's disease. Bibliography. Index.

In this book the distinguished Professor of Medicine at Harvard University gives his mature views on diseases of the kidney, which has been his principal subject of study for 47 years. There is a preliminary section of 138 pages which deals competently with the anatomical, pathological and physiological problems. Of special interest is the method of classification of nephritis. This is based on clinical rather than pathological and etiological criteria. It is not claimed that it is ideal but that it has the advantage of ease for clinical use and foretells with considerable accuracy how the disease will progress. The main divisions are: (i) acute Bright's disease, haemorrhagic type or type without nephrotic syndrome; (ii) acute, subacute and chronic edematous Bright's disease, nephrotic type; (iii) subacute and chronic haemorrhagic Bright's disease, and (iv) chronic non-oedematous Bright's disease. The text indicates that division (i) includes substantially all acute cases with or without oedema, the cases in division (ii) being subacute or chronic. This classification obviously cuts across the pathological basis to which we are accustomed.

Each section contains a number of illustrative cases reported in sufficient detail and so clearly that one can readily visualize the clinical appearance. It is of interest to observe how closely these cases fall into the appropriate division of the system of classification adopted. It might be unwise for an unqualified student in Great Britain to follow this method of classification. But to the postgraduate student, or to those who pay special attention to nephritis, the book is of the highest value. The statements in the text are based on a lifetime of study and observation. Any intelligent reader can reclassify the types as he pleases without affecting the material presented in the pages.

The text is clearly written and is easy to read and comprehend. The printing and paper are good, though there is a misprint on page 640 (3). The price seems somewhat high.

Henry Tidy

## 1556 Arterial Hypertension

David Ayman. Edited by Henry A. Christian. New York : Oxford University Press ; London : Geoffrey Cumberlege, 1948. (Reprinted from Oxford Loose-Leaf Medicine with the same page numbers as in that work.) iv + 93 + 2 pages. 24 x 16 cm. 12s. 6d. [£0.625]

(i) Introduction; (ii) history; (iii) etiology; (iv) pathological physiology; (v) pathology; (vi) constitutional type in hypertension; (vii) symptoms; (viii) evolution of essential hypertension from earliest stages; (ix) physical findings; (x) X-ray studies; (xi) electrocardiograms; (xii) other laboratory data; (xiii) differential diagnosis; (xiv) treatment. Bibliography. Index.

The experience of the last 15 years in the experimental production of hypertension in laboratory animals, and in the efforts to treat hypertension in man by such drastic procedures as lumbodorsal

sympathectomy, has led to a tremendous advance in our fundamental ideas of the nature of this most important, common, and intriguing condition. For those practitioners who wish to understand the modern outlook the monograph under review will form an excellent primer. It is impossible in some ninety pages to cover the whole subject of hypertension adequately. Dr Ayman succeeds, however, both in giving a balanced account of some of the more outstanding contributions to knowledge in recent years and in conveying appropriate instructions for the investigation and care of the hypertensive patient. The reader will find in this book full accounts of the part played by heredity, the nervous and psychological make-up of the patient, and the more measurable underlying organic faults such as the Goldblatt kidney and varied endocrinological disturbances. Body-build, racial factors, and the like are all given their proper place.

One or two matters of practical management, however, may seem strange to British readers. The author has been partly responsible for the habit of instructing patients, or members of their family, to take their own blood-pressures, and in one section of the book there is considerable discussion of the value of these "home readings". We should doubt whether such efforts on the part of the patient are for his benefit. In certain susceptible individuals they would undoubtedly do a great deal to increase the apprehension and misery of the patient. Sympathectomy is critically reviewed but the author is obviously a little biased in its favour. Taken by and large, this procedure has been a disappointing one, and we still do not know how to select the occasional case which admittedly does have a favourable response to the operation. Ayman thinks that the operation may do good even if it only abolishes the rises of blood-pressure which occur with emotion and excitement. The rice diet is discussed somewhat briefly, but perhaps this is of little importance, as enthusiasm for this line of therapy is as likely to wane with the years as enthusiasm for sympathectomy. It is curious to see it included under the heading of "Ineffectual forms of treatment". Treatment with potassium thiocyanate is recommended. A good deal of trouble has to be taken to control the blood-levels of this substance and it seems doubtful if the gain is worth the effort.

These, however, are minor criticisms in what is a useful and well-balanced monograph. We must admit that there is as yet no satisfactory treatment for this distressing condition and whatever line is taken by an author in a clinical publication is always open to easy attack. Dr Ayman has succeeded well in his task and no doubt when he writes the section again for a future edition the instructions on the care of patients will differ widely from those which are given in the present monograph.

J. McMichael

## 1557 An Introduction to Cardiology

Geoffrey Bourne. London : Edward Arnold & Co., 1949. viii + 264 pages ; 65 figures. 22 x 14 cm. 18s. [£0.9]

Section I. Examination of the heart. (i) History-taking and physical examination; (ii) special methods of investigation. Section II. Heart failure. (iii) The nature of heart failure; (iv) the symptoms of heart failure; (v) the signs of heart failure; (vi) the treatment of heart failure. Section III. The myocardium. (vii) Diphtheritic myocarditis; (viii) rheumatic carditis; (ix) myocardial degeneration; (x) the thyroid gland and heart disease; (xi) the heart in anaemia. Section IV. Cardiac disorders and irregularities. (xii) Premature beats; (xiii) paroxysmal tachycardia; (xiv) auricular flutter; (xv) auricular fibrillation; (xvi) heart block; (xvii) bundle-branch block. Section V. Pericardial disease. (xviii) Acute pericarditis; (xix) chronic pericarditis. Section VI. Valvular disease. (xx) Mitral disease; (xxi) aortic regurgitation; (xxii) aortic stenosis; (xxiii) disease of the tricuspid valve; (xxiv) congenital heart disease; (xxv) malignant endocarditis. Section VII. Vascular disease and the heart. (xxvi) The effects of arteriosclerosis upon the heart; (xxvii) hypertensive heart disease; (xxviii) cardiac infarction; (xxix) angina of effort; (xxx) left submammary pain and angina innocens; (xxxi) cor pulmonale; (xxxii) aneurysms. Section VIII. (xxxiii) The heart in pregnancy; (xxxiv) effort syndrome; (xxxv) cardiac signs in symptom-free young adults; (xxxvi) cardiac symptoms and signs in general medical diseases. Index.

This book is written for those who are relatively inexperienced in cardiology. Dr Bourne has aimed at providing a sound working knowledge and has wisely refrained from including the more specialized methods of investigation. Heart failure remains the central problem, and a readable and balanced account of this occupies four chapters. Individual disorders are methodically presented, and the scheme adopted should induce a good approach at the bedside. Use of the term "myocardial degeneration" as a clinical entity is perhaps open to criticism since it is but rarely the dominating factor. Among the best chapters is that devoted to the difficult subject of the heart in thyroid disease. It may be added,

however, that thyroid extract sometimes fails to alleviate angina in myxoedema, and may even render it more severe. Conduction defects and arrhythmias are illustrated by well-chosen electrocardiograms, a minor omission being the chest lead changes in bundle-branch block. There is sound advice on the recognition of pericarditis in all its forms, but not all cardiologists would consider auricular fibrillation a deterrent to operation in constrictive pericarditis.

Turning to mitral disease, the author firmly supports the contention that stenosis and incompetence, though often co-existing, are clinically separable entities. He considers mitral regurgitation alone to be relatively innocuous, and attributes eventual heart failure to weakening of the left ventricle by the original disease. Aortic valve disease is well portrayed, and the important point is made that both thrill and murmur of aortic stenosis may disappear with the advent of failure. There is an excellent chapter on congenital heart disease, which reflects the increased importance of the subject. Writing of hypertension the author considers that raised blood-pressure by itself produces no deleterious effect on the heart, but that with added coronary atheroma and myocardial degeneration the already hypertrophied left ventricle becomes rapidly enlarged. From the clinical view-point, however, many cardiologists would consider hypertrophy as evidence *per se* of heart disease, and some would correlate its degree with the duration of failure. There is a very useful section on the management of these difficult cases. Triple rhythm in the early stages of cardiac infarction would have deserved mention; though not invariable, it is valuable evidence when an electrocardiogram is unobtainable. A diagram showing the sites for routine chest leads would usefully supplement the text, which is somewhat misleading with regard to leads 5 and 6.

Dr Bourne writes in the scholarly style which we have come to expect from him, often illustrating his remarks with novel analogies and striking case examples. Although his views are occasionally unorthodox, he has succeeded in supplying both stimulus and basis for a fuller knowledge of the subject.

Robert Benson

## 1558 Cardiology

William Evans. London: Butterworth & Co. Ltd., 1948. xi + 310 + 20 pages; 269 figures. 25 × 17 cm. £1 15s. [£1.75]

(i) History taking and physical examination; (ii) heart sounds and murmurs; (iii) cardiac enlargement; (iv) arrhythmia; (v) congenital cardiovascular disease; (vi) diseases of the pericardium; (vii) endocarditis; (viii) aortitis; (ix) cardiac pain; (x) hypertension; (xi) the heart in disease of the lungs; (xii) heart failure; (xiii) heart disease and pregnancy; (xiv) the heart in endocrine disorders; (xv) the heart in miscellaneous conditions; (xvi) other vascular diseases and effects; (xvii) the life and livelihood of patients with heart disease. Index.

No fewer than 11 new textbooks on heart disease have appeared in English since 1947. Several of these have been inspired, if the word may be used in a broad sense, by an author's preoccupation with his own particular cardiological interests, others by a dissatisfaction with the previous form or technique of presentation of the subject. Many of them have seen the light of day on the most slender pretexts, and presumably are sustained by the allegiance of the medical school where they originated. Dr William Evans' book will not find itself in such company. Its content and form of presentation are not stereotyped and, time and again, new view-points of well-worn subjects are put forth with quiet candour. So often do they skirt the supposedly unorthodox that the casual reader may find himself at times doubting Dr Evans' words. However, one feels that this book was not written for the casual reader, and that a few of the rather unusual statements are thought-provoking, somewhat disturbing to one's own complacency, and certainly a stimulus to more careful clinical observation in the future. The author is perhaps at his best when he is quietly tilting against time-honoured methods of teaching.

The reviewer was visiting the United States when the first copies of the present book reached that country. He recalls the astonishment that greeted Dr Evans' definition of a raised blood-pressure, namely "... when the systolic pressure is 180 or over, and/or the diastolic pressure is 110 or over ..." and in the presence of clinical, radiological and cardiographic evidence of cardiovascular hypertrophy. These figures, even higher than the usually accepted levels in this country, were little short of startling in the United States, where a blood-pressure of a few millimeters greater than the sacrosanct 150/90 is regarded as quite a serious matter.

Acquaintance with Dr Evans' refreshing methods of teaching clinical cardiology to students and postgraduates will help in understanding the underlying philosophy of his book. There is much to praise in it and a little to criticize. He sounds a well-timed warning against what he calls "unwarranted cardiac invalidism", and this healthy advice re-echoes throughout the book. He rightly identifies auricular flutter with auricular tachycardia, but no mention is made of ventricular tachycardia. An unfortunate emphasis is laid on mean axis deviation in the electrocardiogram and as a result the more important signs of ventricular hypertrophy tend to be overlooked. This defect is clearly shown in an electrocardiogram of congenital subaortic stenosis (fig. 112) described as showing right axis deviation; it deserved the additional comment that chest leads would have demonstrated left ventricular hypertrophy. No mention is made of the value of chest leads in bundle branch block.

Since the book is addressed to medical students and general practitioners, a detailed account of recent advances in haemodynamics, cardiac catheterization or angiocardiology is not called for. One would have supposed, however, that the use of penicillin in cardiovascular syphilis would deserve mention either in support or condemnation and that dicumarol was promising enough to warrant more than six words.

In this book, medical students and general practitioners will find emphasis laid on the facets of heart diseases which concern them and will read and refer to it with profit. The selection and high quality of reproduction of the figures and especially of the teleradiograms are a credit to the author, the medical technicians and the publisher.

W. S.

## 1559 Cardiovascular Disease in General Practice

Terence East. Third edition. London: H. K. Lewis & Co. Ltd., 1949. x + 208 pages; 34 illustrations. 22 × 14 cm. 15s. [£0.75]

(i) The interpretation of symptoms; (ii) physical examination of the heart; (iii) heart failure; (iv) the treatment of heart failure; (v) failure of the coronary circulation; (vi) peripheral failure; (vii) the infections of the heart; (viii) subacute bacterial endocarditis; (ix) cardiovascular syphilis; (x) chronic valvular disease; (xi) pericarditis; (xii) hypertension; (xiii) thyrotoxicosis; (xiv) auricular fibrillation and flutter; (xv) ectopic disorders of rhythm; (xvi) disorders of conduction; (xvii) the cardiovascular system in anaemia, chronic pulmonary disease, chronic renal disease, minor infections, anaesthesia, pregnancy, athletics, deficiency conditions; (xviii) diseases of arteries and veins; (xix) congenital diseases of the heart; (xx) the heart in middle age and onwards; (xxi) some aberrations and the normal heart. Index.

There have been so many advances in cardiology during the past few years that the author has rightly decided to bring out a 3rd edition of this useful aid to general practitioners. The 2nd edition was published in 1946<sup>1</sup>. The new material is found chiefly in the sections on heart failure, ischaemic heart disease, high blood-pressure, congenital heart disease, pulmonary heart disease and thyrotoxicosis. Nevertheless, there are still no details of the low sodium diet, which is certainly the most important advance in the treatment of heart failure; the only practical change in the management of cardiac infarction is the selection of cases suitable for anticoagulant therapy, and this is not discussed; some information concerning the value of penicillin in the treatment of cardiovascular syphilis would have been welcome; the picture of pulmonary heart disease is not convincing, and essential points such as signs of vasodilatation, the difference between central and peripheral cyanosis, the masking effects of emphysema on the second heart sound, and the frequency of coincidental hypertension are not mentioned; in the treatment of thyrotoxicosis one is left with the impression that methyl thiouracil has practically replaced surgery, and that the general practitioner might well carry out the whole of the treatment himself—a view that may well be maintained by the author with some justification, but not one about which there is wide agreement; some further comment on the general therapeutic problem would not have been out of place.

These are criticisms of the newer work that has been incorporated in the book, and detract little from its original value, which was in the successful presentation of the elements of cardiology to the busy practitioner in the simplest and shortest way. To cover so much ground in 200 pages, omitting little of practical importance, apart from what has been mentioned above, is very commendable. The absence of electrocardiograms and x rays does not matter, because their interpretation should be left to the specialist.

Paul Wood

<sup>1</sup> For review, see *BMB* 1151.—Ed.

# 1560 B.C.G. Vaccination in Theory and Practice

K. Neville Irvine. Oxford : Blackwell Scientific Publications, 1949. xiii + 130 pages. 22 x 14 cm. 9s. 6d. [£0.475]

(i) History; (ii) the theory of vaccination; (iii) the production of the vaccine; (iv) variation in the virulence of B.C.G.; (v) virulence experiments in animals; (vi) the safety of B.C.G. vaccination for man; (vii) the resistance produced in animals; (viii) the resistance produced in man; (ix) the technique of vaccination; (x) a world survey of B.C.G. vaccination; (xi) discussion. Index of authors. Subject index.

Dr Irvine has produced an extremely useful and compact little book and, despite the great amount of matter condensed in its pages, he has contrived to make it clear and convincing. The lay-out is good, and the evidence offered for and against the different aspects of BCG theory and practice so clearly and compactly set forth that interest leads the reader on from chapter to chapter.

After mentioning other attempts to confer immunity, Dr Irvine outlines the evolution of BCG vaccine, the methods of its preparation and the theory behind its use. He summarizes the evidence for believing that the strain may be less virulent now than before 1930 owing to the dying out of the "S" variants, and discusses the possible attenuation of the strain in the future. His summary of the reasons for believing that present-day BCG is harmless is convincing. The weight of evidence he produces for considering that BCG confers immunity is fairly conclusive, though this must vary considerably in different populations and age-groups. As he says, any increase in immunity is better than none. His chapter on technique of vaccination is most useful.

In some of Dr Irvine's comparisons of morbidity rates in patients vaccinated and in control cases one is doubtful whether those developing "pulmonary tuberculosis" all had post primary lesions or merely the primary infection. Dr Irvine can, of course, only quote the literature as published. His discussion as to whether those vaccinated should be segregated or not, both before and after vaccination, is useful. He recommends the former, but the chest physician in Britain, at least, will find that the necessity for segregation will greatly reduce the number of contacts he can vaccinate. The difficulty is not only in arranging for segregation but in ensuring that a sufficient number are segregated at the same time, so that a BCG vaccination session becomes profitable. This is a most important point and the proper solution is the widespread boarding-out of contacts by local authorities and, preferably, the establishment of BCG teams.

Incidentally, for the help of those reading this book, Dr Irvine uses the term tuberculin "inversion", instead of tuberculin "conversion", in discussing tuberculin skin tests.

E. Aslett

# 1561 Die Tuberkulose des Kindes. Ein Lehrbuch aus der Kinderheilstätte, Wangen im Allgäu

Heinrich Brügger, Reiner W. Müller & Maria Birkenfeld. Stuttgart : Georg Thieme, 1948. viii + 340 pages; 209 illustrations. 25 x 18 cm. 16 Mk.

(i) Allgemeines über die Tuberkulose-Infektion und -Krankheit; (ii) allgemeine diagnostische Hilfsmittel; (iii) die endorhorakale Tuberkulose des Kindes; (iv) die Tuberkulose im Bereich des Halses und des Bauches; (v) Tuberkulose des Skelettsystems und der Weichteile; (vi) Hauttuberkulose. Index.

This textbook is designed to cover the whole of the subject of tuberculosis in children. Dr Brügger, who has evidently had long experience in his sanatorium for children at Wangen in southern Württemberg, is the editor and main contributor. Emphasis is laid on the general nature of the tuberculous disease process in childhood and the fact that it is seldom entirely confined to one part of the body. These facts are constantly kept before the reader and, in spite of the triple authorship, the book is successful in maintaining continuity and balance in the subject-matter and in avoiding needless repetition. Advances made in the post-war years receive no mention. This is hardly surprising, as, although published in June 1948 the book was completed in October 1946 and the authors had no access to foreign literature after 1939. The omissions are naturally most noticeable in the sections on therapeutics; under the heading of chemotherapy, only gold is mentioned (and, incidentally, condemned). BCG inoculation, not carried out in Germany since the Lübeck disaster, is considered shortly but with approval.

In his opening section, Dr Brügger clearly sets forth the generally accepted views on the natural history of tuberculosis. The section on diagnostic measures contains a particularly useful and compre-

hensive account of the methods of tuberculin tests and their significance. Over one-third of the book is devoted to primary intrathoracic tuberculosis, its complications, prognosis and treatment. Although the important part played by the complication of atelectasis is recognized, the reader is left wondering if some of the radiograms of the "benign perifocal infiltrations" do not really represent the former condition. For instance, fig. 20 might well be a collapse of the lateral segment of the right middle lobe and, in this connexion, it is unfortunate that for 40 anteroposterior radiograms of the benign infiltrations and atelectases there are only four lateral views. Again fig. 128, illustrating "basal triangles" in per-tussis, appears to represent bilateral basal collapse. There is no mention of the treatment of atelectasis by bronchoscopic suction and the rarer condition of obstructive lobar emphysema is not discussed. In the section on differential diagnosis, insufficient attention is paid to the question of collapse of non-tuberculous origin and a second edition will, no doubt, devote more space to the differential diagnosis of tuberculous meningitis, now that its early recognition has become so important. Adult-type tuberculosis in children is fully considered.

Dr Müller gives excellent accounts of the clinical findings and course of tuberculosis of the neck and abdomen. The section on tuberculous disease of the skeletal system is well arranged and Dr Birkenfeld's accurate descriptions of the clinical findings in tuberculous infections of individual bones and joints are particularly good. She rightly lays stress on the importance of early recognition of skeletal involvement. This treatise is obviously based on the author's very considerable experience and wide reading. Where a description of some infrequent manifestation is not based on personal observation, this is clearly stated. One is left with the impression that the authors are not only experienced in the subject of tuberculosis but are also good paediatricians, well understanding the difficulties of diagnosis and of prolonged hospital treatment in young children.

Most of the 209 illustrations are positive reproductions of radiograms and, though varying in quality, are for the most part as good as the paper permits and clearly demonstrate what is required. The text is interspersed with many illustrative case histories. There are 278 references, mostly to German works. The print is clear and the language not too circumlocutory.

The reviewer has no hesitation in commending this book, not only to senior students and trainee paediatricians, but also to physicians working in this branch of medicine.

J. P. M. Tizard

# 1562 Ankylosing Spondylitis : a Practical Guide to its Diagnosis and Treatment

F. Hernaman-Johnson & W. Alexander Law. London : Butterworth & Co. Ltd., 1949. viii + 200 pages; 41 figures. 22 x 14 cm. £1 5s. [£1.25]

Part I. (i) The spondylitic syndrome; (ii) aetiology and pathology; (iii) clinical diagnosis; (iv) radiographic diagnosis; (v) some reflections on treatment; (vi) X-ray treatment; (vii) vaccines; (viii) gold, bismuth and arsenic; (ix) thorium X; (x) general management of patients with spondylitis; (xi) mental factors : occupation, sex and marriage; (xii) cortisone and prednisolone in the treatment of "rheumatism," including spondylitis; (xiii) concluding remarks. Part II. (xiv) Conservative treatment; (xv) correction of the spinal deformity by osteotomy of the spine; (xvi) hip joint reconstruction by vitalium mould arthroplasty; (xvii) surgical treatment of joints less frequently involved in ankylosing spondylitis. Index.

This small monograph deals with the subject of ankylosing spondylitis from the somewhat doctrinaire point of view which is associated with the Charterhouse Rheumatism Clinic, of which the late Dr Hernaman-Johnson was physician. The "wide-field" technique of x-ray treatment is recommended in preference to the more commonly accepted "deep" technique, although it is said: "It must be admitted that, in Great Britain, the wide-field method has made little progress." The next method of attack upon the disease to be discussed is the use of vaccines, a procedure which the author admits to be "purely empirical", and one which has lost favour with other schools of rheumatological thought.

In the following chapter the use of gold salts, bismuth and arsenic is advocated. It is claimed that the first "almost deserves the name of a specific"—a view which is very far from representing the general opinion in this or any other country at present. Finally, the use of thorium X is recommended with enthusiasm. The author's remarks on the general management of patients with spondylitis are sensible and wise, and he has managed to include a brief chapter on cortisone and its relations.



Mr Alexander Law contributes the last four chapters, on the surgical treatment of the effects of ankylosing spondylitis, and this section will be read with interest and profit by all who are engaged in this field.

W. S. C. Copeman

### 1563 Surface and Radiological Anatomy: for Students and General Practitioners

Originally written by A. B. Appleton, W. J. Hamilton & Ivan C. T. Chaperoff. Third edition by A. B. Appleton, W. J. Hamilton & G. Simon. Cambridge: W. Heffer & Sons Ltd., 1949. viii + 332 pages; 390 figures. 25 x 19 cm. £1 15s. [£1.75]

General anatomy and methods. The upper limb. (i) Shoulder and arm; (ii) elbow, forearm and hand; (iii) vessels and nerves. The chest and back. (iv) Thoracic wall; (v) thoracic contents; (vi) physical examination of the thorax; (vii) great vessels; (viii) oesophagus. Abdomen. (ix) Abdominal wall; (x) physical examination of the abdomen; (xi) abdominal contents; (xii) perineum; (xiii) deep blood-vessels of the abdomen. Head and neck. (xiv) General features; (xv) the neck; (xvi) special organs and regions; (xvii) vessels and nerves; (xviii) the brain and its associated vessels; (xix) radiology. The vertebral column. The lower limb. (xx) Buttock and thigh; (xxi) region of the knee; (xxii) leg and foot; (xxiii) vessels and nerves. Index.

It is doubtful whether any single textbook can cover so wide a field as surface anatomy and radiological anatomy and yet meet the needs of both students and general practitioners. No one has yet succeeded in combining the best of the material in the textbooks of surface anatomy as they existed in the pre-Röntgen days with the best of the material in the books on radiology.

The most concentrated and precise presentation of surface anatomy was that of the late Sir Harold Stiles of Edinburgh, and this was first published as the last section of Cunningham's *Text-book of anatomy* in 1902. The most extensive and accurate presentation of radiological anatomy in any language is Alban Köhler's *Röntgenologie*, translated into English by A. Turnbull. The first German edition appeared in 1910 and the first English translation, of the 5th edition, was published in 1928. Köhler, by a stroke of genius, supported by incomparable clinical experience, gave the first and only clear survey of the borderlands of normal and of early pathological conditions in the radiograph. The combination of anatomy and radiology as presented by Stiles and Köhler is still unapproached, and most difficulties can be solved by reference to the one or the other.

The book under review contains a mass of detailed information of use to the student, but lacks any statement of those general principles which allow the student to organize the detail into a concrete whole. The anatomical illustrations are of the high quality expected from such a competent medical artist as A. K. Maxwell. The radiographs are well selected but their reproduction still leaves much to be desired. A well-reproduced radiograph demands a paper of photographic quality and this involves much expense.

The more recent techniques of tomography, ventriculography and pneumatization are presented in detail. A brief statement of the qualities of an adequate radiograph of any part of the body might be of help to the student, for it is the radiograph itself rather than any printed reproduction of it which gives the maximum information.

H. A. Harris

### 1564 Neuroradiology

Alexander Orley. Oxford: Blackwell Scientific Publications, 1949. xii + 421 pages; 572 figures. 26 x 18 cm. £3 3s. [£3.15]

(i) Radiography of the skull; (ii) radiography of the temporal bone; (iii) sphenoidal sinuses; (iv) the sphenoidal fissure; (v) cranial foramina; (vi) tomography; (vii) cranial deformities; (viii) head injuries; (ix) lesions of the cranium; (x) changes in the skull associated with systemic diseases; (xi) asymmetry of the skull; (xii) radiographic changes in the feeble minded; (xiii) non-pathological intracranial deposits of calcium; (xiv) displacement of calcified normal intracranial structures by space occupying lesions; (xv) pathological intracranial calcification other than neoplasms; (xvi) degenerative conditions in which abnormal intracranial calcification is usually absent; (xvii) increased intracranial pressure; (xviii) cranial and cerebral circulation; (xix) vascular tumours and anomalies of the brain; (xx) cerebral angiography; (xxi) arteriography in lesions of the blood vessels; (xxii) diagnosis of the histological structure of tumours from the angiogram; (xxiii) peripheral arteriography; (xxiv) cerebral neoplasms; (xxv) lesions and deformities of the sella turcica and parasellar lesions; (xxvi) meningioma; (xxvii) acoustic nerve tumours; (xxviii) congenital tumours; (xxix) tumours of the blood vessels of the brain; (xxx) metastatic tumours; (xxxi) calcified tuberculoma of the brain; (xxxii) intracranial abscess; (xxxiii) air studies of intracranial lesions; (xxxiv) interpreta-

tion of the normal ventriculogram; (xxxv) ventricular measurements; (xxxvi) different radiographic projections used in ventriculography; (xxxvii) encephalography; (xxxviii) ventricular changes following head injury; (xxxix) porroencephaly; (xl) arachnoiditis; (xli) encephalography in cases of mental deficiency and epilepsy; (xlii) ventriculography; (xliii) lesions and anomalies of the spine and spinal cord; (xliv) spinal injuries; (xlv) posterior prolapse of the intervertebral disc; (xlvi) spinal tumours; (xlvii) forecast of the histological nature of the tumour from radiographic evidence; (xlviii) myelography; (xlix) neuropathic disturbances. Bibliography. Index of authors. Index.

The author states that the greater part of the material on which this book is based was collected during the war of 1939-45. The field of neuroradiology during this period in Britain was somewhat restricted because of the divorce from free contact with the work in progress in other countries. This book reflects the situation. The author has read widely in his subject, as the very complete bibliography witnesses. It must, however, be realized that the material of the book and the opinions expressed therein are far behind present-day thought and methods.

The section on cerebral angiography is an outstanding example. The contrast material advocated is considered by most workers to be dangerously radioactive. The open method of injection described has been abandoned, in other than exceptional cases, in the percutaneous technique. The reproductions of angiograms are for the most part poor and cover little of the field of demonstrable abnormalities.

The technique of positioning in ventriculography is well described, but in the section on abnormal ventriculographic findings only four projections are used in the diagrams. The art of ventriculography lies in suiting the technique in each case to the initial findings, in order fully to demonstrate the lesion for the guidance of the neurosurgeon. There is little suggestion of the importance of this. The section on the technique of myelography is headed most misleadingly "Lumbar encephalography". Some of the statements which follow would be regarded as dubiously accurate by the majority of experienced workers in this field, and no mention is made of the possible use of opaque media other than iodized oil.

The standard of production of the book is high and it is the greater pity that some of the radiographs reproduced, notably those on pages 101-103 and 120, fail to demonstrate to the reader the conditions described. In the section on radiography of the temporal bone there are full instructions for radiographic procedure, though the standard American and Swedish projections are ignored, while adequate anatomical explanation of the resulting radiographs is not given. The format of this book is excellent, but the subject deserves a volume of much greater size and scope, and a wider basis in material. In the last 15 years this specialized field in radiology has produced evidence which has greatly influenced thought and procedure in neurology and neurosurgery. Technique has advanced rapidly in the past five years, and it was perhaps inevitable that, by the time the book was published, some of the statements in it should be behind current opinion.

### 1565 A Descriptive Atlas of Radiographs. An Aid to Modern Clinical Methods

A. P. Bertwistle. Seventh edition, revised and enlarged. London: Henry Kimpton, 1949. xxx + 622 pages; 980 illustrations. 26 x 18 cm. £2 10s. [£2.5]

(i) Radio-diagnosis; (ii) cancer campaign; (iii) X-ray museum; (iv) the clinical application of radiology; (v) X-rays in the diagnosis of internal disease; (vi) milestones in radio-diagnosis; (vii) silhouette radiograph process; (viii) normal bones and epiphyses; (ix) congenital abnormalities; (x) fractures; (xi) diseases of bones; (xii) tumours of bone; (xiii) injuries and diseases of joints; (xiv) nasal system; (xv) dental system; (xvi) alimentary system; (xvii) urinary system; (xviii) respiratory system; (xix) nervous system; (xx) vascular system; (xxi) ductless glands; (xxii) female generative system; (xxiii) muscles; (xxiv) medico-legal; (xxv) embryology; (xxvi) anthropology; (xxvii) helminthology; (xxviii) occupational diseases. Index.

The compiler of an atlas of radiographs who wishes to limit himself to one volume must always be faced with the problem of deciding on those examples which must be included and those which can be excluded. To be complete, many examples of every disease process would be needed, for there is no such thing as a typical appearance. Mr A. P. Bertwistle, in the 7th edition of this well-known book, has made a fairly representative selection, but there are some inevitable gaps.

In his introduction he declares that his aim is to show the capabilities of x rays and in the main he succeeds in this, but one regrets the omission of any examples of angiocardigrams, the recent development of which would appear to be of increasing importance. Few heart conditions, indeed, are represented. One would also



like to see examples of lateral chest films demonstrating lobar and segmental lung lesions. The appearance in this edition of a section on helminthology is welcome, though the reproductions are not, perhaps, quite up to the standard of the rest of the work. One would have welcomed a general word on capabilities and limitations as an introduction to each section.

The book is well produced and pleasingly free of misprints. The x-ray reproductions are, however, positives; to some, this may be a disadvantage. Many of the plates are accompanied by useful line diagrams which greatly assist in interpretation.

The book includes a most interesting and informative chapter on the milestones in radiodiagnosis; however, a bibliography of the work referred to would have been a useful addition.

This atlas should prove of value to the practitioner who is taking an intelligent interest in the ever-expanding science of radiodiagnosis and also to the student, as a supplement to that study of radiology which can truly be accomplished only at the bedside.

F. D. Beddard

## 1566 Standard Radiographic Positions

Nancy Davies & Ursel Isenbarg. Second edition. London: Baillière, Tindall & Cox, 1947. viii + 223 pages; 384 figures. 23 x 16 cm. £1 1s. [£1.05]

(i) Upper extremity; (ii) shoulder girdle; (iii) lower extremity; (iv) pelvic girdle; (v) spinal column; (vi) thoracic bones; (vii) skull; (viii) teeth; (ix) internal organs; (x) localisation of foreign bodies; (xi) stereoscopic radiography; (xii) the X-ray department; (xiii) the patient. Exposure chart. Index.

This book has been considerably enlarged since the 1st edition, and the radiographic data included have been brought up to modern standards. The section dealing with the skull, sinuses and mastoid positions is very ably written, and the diagrams are a useful reference for information about the various projections required by radiologists. The section on the preparation of the patient for various x-ray examinations is also very useful. Although preparation varies slightly in different departments the book is a good general guide to radiographers. For example, the section on bronchography includes a list of needles, dressings, forceps, etc., required during the examination. Other radiographic procedures are equally well described. The exposure chart section is concise and can be adapted to suit individual requirements on different types of x-ray apparatus.

This work will be an invaluable aid to student radiographers at the commencement of their training and the diagrams will be of assistance to them in anatomical drawing. It would be useful as a reference book in any x-ray department. The authors and publishers are to be congratulated on a good production, which has the added advantage of being reasonable in price.

L. Smith

## SURGERY

### 1567 Operative Surgery

Frederick C. Hill. New York: Oxford University Press; London: Geoffrey Cumberlege, 1949. xii + 698 pages; 255 figures. 24 x 16 cm. £3 3s. [£3.15]

(i) Preoperative treatment; (ii) general considerations; (iii) sutures, ligatures, and instruments; (iv) the skin and subcutaneous tissue; (v) the mouth, tongue, and salivary glands; (vi) the neck; (vii) the mammary gland; (viii) the pleura and lung; (ix) the mediastinum and contents; (x) the abdominal wall; (xi) the peritoneum, retroperitoneal tissue, and adrenal gland; (xii) the liver; (xiii) the gallbladder and bile ducts; (xiv) the pancreas; (xv) the spleen; (xvi) the stomach; (xvii) the duodenum; (xviii) the jejunum and ileum; (xix) the appendix; (xx) the colon; (xxi) the rectum and anus; (xxii) the uterus, Fallopian tube, and ovary; (xxiii) the female external genital organs, perineum, and vagina; (xxiv) the kidney and ureter; (xxv) the bladder and prostate; (xxvi) the male external genital organs; (xxvii) the bones and joints; (xxviii) the blood vessels; (xxix) the extremities; (xxx) postoperative treatment. Index.

Professor Hill, Associate Professor of Surgery in the Creighton University School of Medicine, Omaha, Nebraska, has produced a textbook of operative surgery suitable for students, interns, and junior surgeons. For the coverage of operative surgery which it affords, the book is compact. Not only technical details of operations are described, but pre-operative and postoperative treatment are considered at some length, and the positioning of the patient on the table and the draping of the operation field are explained in fuller detail than in most textbooks; surgical pathology, also, is well described. General operative methods, such as the tying of knots and the insertion of stitches, together with the different uses of the common surgical instruments, are very simply and concisely handled. In general, the author advises for each condition one single technique which he himself has found suitable, and which in most cases is a standard operative procedure. A careful selection has been made of relatively common procedures, and out-of-the-way operations are not described at any length. Plastic surgery is considered fairly fully, and the section on chest surgery is just what the undergraduate student requires. In most of the chapters dealing with the anatomical regions, operations which have a purely historical interest have been wisely omitted; in the chapter on the stomach, however, this does not altogether apply. The Roux type of anastomosis is described, for example, as also is wedge resection of a gastric ulcer. Approximately one-tenth of the book is devoted to gynaecology.

Perhaps the strictest selection has been in relation to orthopaedics, but, occasionally, the operations chosen for description seem a little strange. The general management of amputations, for example, and the principles which govern amputations at given levels, are rather inadequately considered, while a method for the removal of the intervertebral disk is discussed in some detail. It is

proper to say that the precise operative technique for amputations at the common levels is described.

The lay-out of the textbook is really excellent, the style is simple, and the book is easy to read. As a review of the field of operative surgery for the undergraduate student it can be very highly commended.

Ian Aird

### 1568 A Short Practice of Surgery. Parts I-V

Hamilton Bailey & R.J. McNeill Love. Eighth edition. London: H. K. Lewis & Co. Ltd., 1948-49. 1,050 pages; 1,198 figures. 22 x 14 cm. £2 12s. 6d. the set [£2.625]

Part I. (i) Non-specific infections and wounds; (ii) specific infections diseases; (iii) tumours; (iv) ulceration and gangrene; (v) blood and blood-vessels; (vi) lymphatics and lymphatic nodes; (vii) face and jaws, including the palate; (viii) teeth and gums; (ix) mouth and tongue; floor of mouth; (x) salivary glands; (xi) neck; (xii) thyroid gland; (xiii) thymus, parathyroid, and adrenal glands. Index. Part II. (xiv) Pharynx; (xv) oesophagus; (xvi) peptic ulcer; (xvii) stomach and duodenum; (xviii) spleen; (xix) liver; (xx) gall bladder and bile ducts; (xxi) pancreas; (xxii) peritoneum; (xxiii) intestines; (xxiv) intestinal obstruction; (xxv) vermiform appendix. Index. Part III. (xxvi) Rectum and anal canal; (xxvii) hernia; (xxviii) urinary symptoms. Investigation of the urinary tract. Anuria; (xxix) kidneys and ureters; (xxx) urinary bladder; (xxxi) prostate and seminal vesicles; (xxxii) urethra and penis; (xxxiii) testes and scrotum; (xxxiv) skin. Index. Part IV. (xxxv) Head; (xxxvi) spine; (xxxvii) nerves; (xxxviii) special nerves; (xxxix) breast; (xl) thorax; (xli) larynx; (xlii) infections of the hand. Index. Part V. (xliii) Injuries to the bone; (xliv) diseases of bones; (xlv) injuries to joints; (xlvi) diseases of joints; (xlvii) muscles, tendons, and bursae; (xlviii) deformities. Glossary. Index.

It is difficult to know what to say about the re-appearance of so well-known a "Short Surgery" even though it is disguised in five volumes, all coloured differently; but the appearance of an 8th edition speaks adequately for its popularity and use. The authors state that they have presented the book in sections because of the delay between the written and the printed word enforced by economic conditions in Britain today. This reviewer feels, however, that the time-lag, regrettable as it is, is not long enough for the principles of surgery to alter materially, and it is certainly a disadvantage for reference purposes to have a book in small sections.

The authors and publishers are to be congratulated on a very neatly turned out and well-finished series of volumes, which are profusely illustrated, as indeed are all the works of these two authors. While one agrees with the Chinese proverb quoted in the preface: "One picture is worth a million words", one must point out that there is a limit to the reduction in size of that picture, below which it ceases to illustrate the point requiring emphasis. This criticism applies to more than one of the illustrations in this work,

and especially to those, otherwise excellent and valuable, illustrating Dr. Hermitte's admirable pathological disquisitions.

The technical material is well arranged in sections and is dealt with tersely but adequately. All superabundance of detail, both in clinical signs and in treatment, is skilfully avoided. This is as it should be in a work which is intended only as a book of reference for the practitioner and surgeon, and not as the sole textbook of the undergraduate student. The authors are to be congratulated again on having produced a concise and comprehensive work which is of great value as a refresher course and a reference book; and they can feel assured of the continued popularity of their efforts.

Philip H. Mitchiner

### 1569 An Atlas of Traumatic Surgery: Illustrated Histories of Wounds of the Extremities

Josep Trueta. Oxford: Blackwell Scientific Publications, 1949. viii + 150 pages; 188 figures. 25 × 19 cm. £1 10s. [£1.5]

Introduction. (i) Upper limb; (ii) lower limb.

Professor Trueta's work is, as it professes to be, an atlas of many photographs showing the progress and end-results of the author's well-known and oft-advocated treatment of all wounds by early and thorough excision of destroyed and damaged tissue, and as such it pays tribute to the success of his methods and the correctness of his views. He is perhaps inclined to assume that before the Spanish Civil War no thorough and far-reaching excisions with subsequent plaster of Paris immobilization had been undertaken, at any rate with success, in any prior war, but he may rest assured that such methods were practised, and with success, especially by the French military surgeons on the Salonika front in 1916-18. Professor Trueta correctly acknowledges the value of chemotherapy as an adjunct, but *only* as an adjunct, to the success of early root and branch excision of wounds, and rightly stresses that in the presence of chemotherapy delayed union in some eight to ten days should be the routine practice in securing the early closing of the majority of war wounds. The illustrations are well produced, but in some cases might be considered as failing to convey the points required to show the uninitiated surgeon (on Professor Trueta's own admission he is writing hopefully for the presumably uninitiated surgeon in a war in the dim future) the full and terrible destruction of tissues which he must expect to meet and the root and branch surgery which he must carry out promptly and adequately if success is to be attained by these methods.

Professor Trueta is to be congratulated on this work which, like all his previous publications, is clear, helpful and instructive.

Philip H. Mitchiner

### 1570 Demonstrations of Physical Signs in Clinical Surgery

Hamilton Bailey. Eleventh edition. Bristol: John Wright & Sons Ltd., 1949. xii + 426 pages; 657 illustrations. 23 × 14 cm. £1 14s. [£1.7]

(i) Introductory; (ii) some basic physical signs; (iii) some general principles in the examination of joints; (iv) localized swellings; (v) ulcers and sinuses; (vi) the mouth; (vii) the face and jaws; (ix) the head; (x) the ear; (xi) the nose; (xii) the thyroid gland; (xiii) the breast; (xiv) the thorax; (xv) the shoulder, arm, and forearm; (xvi) the hand; (xvii) the foot; (xviii) non-acute abdominal conditions; (xix) non-acute abdominal conditions—special demonstrations; (xx) rectal and vaginal examination; (xxi) clinical examination of the urinary organs; (xxii) the male generative organs; (xxiii) common acute abdominal conditions; (xxiv) abdominal and pelvic injuries; (xxv) some rarer acute abdominal conditions; (xxvi) the sacro-iliac joint; (xxvii) the hip-joint; (xxviii) the knee-joint; (xxix) the leg and foot; (xxx) bone; (xxxi) the spine; (xxxii) the peripheral nerves; (xxxiii) examination of the blood-vessels of the extremities; threatened and established gangrene; (xxxiv) some signs to confirm a suspicion of neurosis. Glossary. Index.

In welcoming this new, 11th edition of Hamilton Bailey's book, one is astonished to find that the 1st edition appeared no less than 23 years ago. One can still recall the immediate and powerful appeal which it made to the medical student and there is little doubt that this latest edition will hold a similar attraction for the students of the present day.

The reason for the initial and continued popularity of this book is not far to seek. The author set out to demonstrate physical signs and to describe clearly to the student how he could elicit these signs, an object which would inevitably meet with the approval of

all medical students. If in any given case the student can obtain an accurate history and can carefully elicit and record the physical signs present, then he has the diagnosis ready-made, as it were. But if, on the other hand, unskilful examination has not only failed to elicit signs present but has discovered signs which in fact are not present, he will be misled by these false data and make a wrong diagnosis. It is, of course, the duty of the clinical teacher to demonstrate to his students how to elicit these signs, but it is a duty which one feels is at times neglected.

The two main methods available to the author, to enable him to fulfil his purpose, were careful descriptions of the methods of examinations, and good illustrations. The descriptions given in this book have always been excellent, clear and concise, but the great, and, at the time of its original publication, the novel virtue of the book was the lavish use of excellent illustrations, mostly first-class clinical photographs. It is perhaps not too much to say that this book when it originally appeared set up a new standard for medical textbooks in this respect.

These original virtues have never been allowed to fade. Indeed with each succeeding edition endeavour has been made to improve on its predecessor. Colour photography has been used increasingly, diagrams are excellent and the whole production reflects great credit on the author and his publishers. The continued popularity of the volume is assured by the issue of this new edition.

T. M. Millar

### 1571 A Text-Book of Surgical Pathology

Charles F. W. Illingworth & Bruce M. Dick. Sixth edition. London: J. & A. Churchill Ltd., 1949. viii + 726 pages; 317 illustrations. 24 × 16 cm. £2 5s. [£2.25]

(i) Inflammation; (ii) wound infections; (iii) constitutional effects of injury; (iv) tuberculosis; (v) actinomycosis; (vi) hydatid disease; (vii) tumours; (viii) diseases of bones; (ix) diseases of joints; (x) diseases of muscles, tendon sheaths and bursae; (xi) diseases of blood vessels; (xii) diseases of lymph glands and vessels; (xiii) diseases of the skull and brain; (xiv) diseases of the spine and spinal cord; (xv) diseases of peripheral nerves; (xvi) diseases of the thorax; (xvii) diseases of the pericardium, heart and great vessels; (xviii) diseases of the breast; (xix) diseases of the mouth, jaws, salivary glands and neck; (xx) diseases of the thyroid gland; (xxi) diseases of the parathyroid glands; (xxii) diseases of the pharynx, larynx and oesophagus; (xxiii) diseases of the stomach and duodenum; (xxiv) diseases of the small intestine; (xxv) diseases of the colon; (xxvi) diseases of the vermiform appendix; (xxvii) diseases of the peritoneum; (xxviii) diseases of the gall-bladder, liver and bile ducts; (xxix) diseases of the pancreas; (xxx) diseases of the spleen; (xxxi) diseases of adrenal glands; (xxxii) diseases of the urinary organs; (xxxiii) diseases of the male generative organs; (xxxiv) diseases of the female generative organs. Index.

The 1st edition of this textbook was published 18 years ago. In this, the 6th edition, there are new chapters on diseases of the heart and blood-vessels; and accounts of vascular hypertension, causalgia, and tumours of muscle have been added. The descriptions of thrombophlebitis, peptic ulcer, intestinal obstruction, and several other conditions have been re-written.

"This book has been written for graduates and senior students" and the authors have made "only passing reference . . . to such fundamental processes as inflammation, suppuration, ulceration and repair." These subjects are dealt with in the first chapter of 11 pages. The "passing references" are elementary and uninspiring and several opportunities are lost of stressing the importance of modern research in inflammation and trauma. Having the seniority of the reader in mind, there seems to be little point in retaining this rather inadequate first chapter, especially as these fundamental subjects are dealt with fully in most standard textbooks of general pathology.

The same criticism applies to the second chapter, dealing with wound infection. The account of the staphylococci occupies 15 lines. The surprisingly high proportion of normal individuals of all ages who carry pathogenic staphylococci in the nasal vestibule is not even mentioned. Staphylococcal coagulase is described as an exotoxin and no mention is made of the important practical value of distinguishing between pathogenic and non-pathogenic strains by testing for coagulase production. The account of the streptococci is brief and contains some inaccuracies. The description of the pathogenesis of gas gangrene is misleading, as no clear distinction is made between the growth requirements of clostridia, which are relatively unimportant, and the local and general lethal effects of specific clostridial toxins, which are fundamental. It is not improbable that students reading this book may be misled into thinking that these references to bacteriology contain all that a well-informed and intelligent surgeon can be expected to know. If this is a real danger, it might be considered advisable in future

editions to omit these "passing references" unless sufficient space can be found to deal with the subjects more fully.

The remainder of the book deals with the morbid anatomy and histology of diseases of surgical importance. It is quite clearly this part of the book which has ensured its popularity with students for the last 18 years. The chapters on the pathology of bone and peripheral vascular disease are outstanding and, of the re-written chapters, that on the spleen is excellent. The problem of fluid balance is given the prominence and careful explanation which it so fully deserves.

Geoffrey Hadfield

## 1572 Acute Injuries of the Head, their Diagnosis, Treatment, Complications and Sequels

G. F. Rowbotham. Third edition. Edinburgh: E. & S. Livingstone Ltd., 1949. xx + 480 pages; 259 figures. 25 x 18 cm. £1 15s. [£1.75]

(i) The mechanisms of injuries of the head; (ii) pathology; (iii) diagnosis of closed injuries of the head; (iv) treatment of closed injuries of the head and surgical technique; (v) fractures of the skull; (vi) open or compound wounds of the head; (vii) traumatic osteomyelitis; (viii) results of injury to special parts of the brain and skull; (ix) the sequels of injuries of the head; (x) rehabilitation; (xi) post-traumatic epilepsy; (xii) the final results of head injuries; (xiii) the mechanism of birth injuries; (xiv) the residual illness. Index of authors. General index.

Mr Rowbotham introduces the subject of acute injuries of the head with a comprehensive and scientific survey of the physical mechanisms by which the skull, the brain and its membranes may lose continuity. He describes and illustrates the pathology of acute head injury anatomically and statistically, and deals at length with the problems of concussion and of the conduct of air-raid casualties. Drawing upon his knowledge of surgical literature, of physics, and of his own experiences, he discusses the diagnosis of closed injuries of the head in terms of the difficulties raised by the complex picture of each head injury and freely gives his opinion on matters of controversy. Whilst his methods of treatment of closed head injuries are not universally accepted, he gives them very full descriptions, and states their indications; closed cranial fractures and defects are described and treated along the usual lines.

Dealing with compound wounds of the head and such complications as cerebrospinal rhinorrhoea, he shows how war experiences have contributed to the treatment of these injuries and how thorough the approach to traumatic osteomyelitis must be. The chapter on injury to special parts of the brain makes interesting reading and has very useful statistical references; with descriptions of the sequelae of head injuries, much space is devoted to the social, psychological and medicolegal aspects of both diagnosis and treatment, and rehabilitation is elaborated with realism. The difficult subject of post-traumatic epilepsy is carefully reviewed and the management of cases of late onset advised. After a short survey of some statistics of late results of head injury, and a summary of the mechanism, diagnosis and treatment of birth injuries, Mr Rowbotham concludes with a final note on the relation between the head injury, the original personality of the individual, and the type and circumstances of the work and society to which the individual returns.

Too controversial and *décousu* for the undergraduate, this book should be read by every resident surgical officer; let him not, however, be deterred by those passages which he cannot understand, for the author boldly attacks all controversial matters and the book is the result of his wide reading and surgical experiences in the field of traumatic craniocerebral surgery.

W. J. Atkinson

## 1573 Abdominal Operations

Rodney Maingot. Second edition. London: H. K. Lewis & Co. Ltd., 1948. xxiii + 1274 pages; 468 figures. 25 x 17 cm. £4 4s. [£4.2]

Part I. Abdominal incisions. Part II. Stomach and duodenum. Part III. Spleen. Part IV. Pancreas. Part V. Gall-bladder and bile ducts. Part VI. Liver. Part VII. The vermiform appendix. Part VIII. Peritoneum, mesentery, omentum. Part IX. External abdominal hernia. Part X. Intestines. Part XI. Post-operative chest complications: diaphragmatic hernia: portal hypertension. Index.

Maingot's *Abdominal operations* was published first in 1940 and quickly achieved recognition as an authoritative work. It covers more than its title indicates, for it is concerned not merely with the technique of operations, but with the whole care of the patient during his stay in hospital. Thus in the chapter on duodenal ulcer,

after sections devoted to etiology, symptoms and diagnosis, there is a discussion on the choice of treatment, followed by a review of the principles of medical care, and finally a detailed account of the operations, with appropriate measures of preparation and after-care.

In this 2nd edition, Maingot has been assisted by several other surgeons. In addition to English colleagues they include Harold Dew of Sydney, who writes on hydatid disease; Lester Dragstedt on vagotomy; and Stuart Harrington on diaphragmatic hernia. Maingot himself, however, remains responsible for the greater part of the book, which thus avoids the unwieldiness and diversity of approach so often to be found in works of multiple authorship.

As is to be expected, the teaching throughout is entirely up to date, and the descriptions of operative technique are sufficiently detailed to be of real value to the surgeon. A special word of praise is deserved for the illustrations, which are excellent.

C. F. W. Illingworth

## 1574 Acute Intestinal Obstruction

Rodney Smith. With a chapter on radiological diagnosis, by Eric Samuel. London: Edward Arnold & Co., 1948. xii + 259 pages; 102 figures. 22 x 14 cm. 18s. [£0.9]

(i) The history of the surgery of acute intestinal obstruction. Pathology. (ii) General principles of pathology; (iii) simple occlusion; (iv) closed loop obstruction; (v) intestinal strangulation; (vi) functional intestinal obstruction; (vii) peritonitis and acute intestinal obstruction; (viii) protein deficiency in intestinal obstructions. Diagnosis. (ix) Clinical diagnosis; (x) radiography in acute intestinal obstruction. Treatment. (xi) The place of chemotherapy; (xii) the place of suction drainage; (xiii) the treatment of protein deficiency; (xiv) the relief of obstruction without operation: the conservative plan. Pre-operative treatment. (xv) The operation; (xvi) postoperative treatment. Individual varieties of acute intestinal obstruction. (xvii) Classifications; (xviii) congenital anomalies; (xix) strangulated external hernia; (xx) strangulated internal hernia; (xxi) obstruction by bands and adhesions; (xxii) volvulus; (xxiii) intussusception; (xxiv) acute obstruction by a neoplasm; (xxv) acute obstruction from inflammatory changes in the gut wall; (xxvi) intraluminal impaction; (xxvii) mesenteric vascular occlusions; (xxviii) functional intestinal obstructions; (xxix) postoperative intestinal obstruction. References. Index.

This practical monograph sets forth a modern account of the problems which present themselves in a case of suspected or confirmed intestinal obstruction. A thoughtful and encouraging foreword by Vaughan Hudson emphasizes the value of radiology in the detection of early obstruction, and pays tribute to former surgeons of the Middlesex Hospital who were pioneers in the diagnosis and treatment of these often difficult cases.

In his preface the author stresses the fact that the obstruction in itself is not immediately lethal, and that correction of dehydration and the adoption of intestinal suction are modern methods of treatment which will often tide the patient over the immediate crisis. The pathology of obstruction is then discussed, and the importance of protein deficiency and the correction of hypoproteinaemia by the oral or intravenous administration of amino-acids is emphasized. The section on diagnosis of acute obstruction is clear and concise, but the clinical examination of the abdomen surely merits more space than less than one page, especially as the chapter on radiography is allotted no less than 27 pages! Intraperitoneal chemotherapy is next considered, but no mention is made of micro-form suspension, which is the ideal preparation for combating peritoneal infections.

The treatment of various types of obstruction is considered in detail. A popular error is reiterated in connexion with a strangulated inguinal hernia, when it is stated that such a hernia is irreducible. The ideal treatment of a strangulated inguinal hernia of less than six hours' duration, provided it is previously reducible, is taxis, i.e., manual reduction. This is often accomplished by the patient himself, or by the medical attendant, and then the desirability of a subsequent operation can be considered at leisure.

It is also stated that, in the case of a strangulated inguinal hernia, abdominal examination reveals signs of early obstruction with hyperperistalsis. This statement may mislead the junior surgeon, as hyperperistalsis is absent in the case of Littre's hernia, or when omentum or a Fallopian tube is present in the sac.

Methods by which the viability of strangulated bowel is assessed are mentioned, but one important omission is the aid which can be given by the anaesthetist. In a doubtful case, the administration of pure oxygen for a period of two or three minutes is sometimes the deciding factor, as the colour of viable gut will then approximate to normal.

Mention is made of "prune juice" stools in acute intussusception. The stools in this condition are more correctly described as re-

sembling red currant jelly, as they are a mixture of mucus and blood. Physicians reserve the term "prune juice" to describe the expectoration which typifies a lung carcinoma. Vague and meaningless terms are not infrequent. How can a thoughtful reader assess such terms as "a fair number of recorded cases" or "a high percentage of cases"? The "baby boy" who is likely to suffer from an acute intussusception would better be described as a male infant of from six to nine months. What are the actual dimensions of the "large" gallstone which becomes impacted in the jejunum? It is generally accepted that a diameter of more than one inch will fail to negotiate the small intestine.

However, in spite of these defects, and other minor ones, which can be corrected in a subsequent edition, this book is a useful guide to a junior surgeon who is responsible for emergency work, and as such it can be warmly recommended.

R. J. McNeill Love

## 1575 Wounds of the Extremities

Edited by H. J. Seddon. Bristol: John Wright & Sons Ltd., 1949. (*British Journal of Surgery War Surgery Supplement No. 2*.) 104 pages; 75 figures. 26 x 18 cm. 12s. 6d. [£0.625]

(i) War injuries of the extremities and their treatment in forward areas; (ii) missile wounds involving bone; (iii) early treatment of penetrating wounds of joints; (iv) war injuries of peripheral nerves; (v) war injuries of the peripheral arteries.

The production, by the *British Journal of Surgery*, of a War Supplement which is devoted to wounds of the extremities, has admirably filled a gap in post-war surgical literature. In general presentation the supplement maintains the high standard of the first War Supplement of the *British Journal of Surgery*, which dealt with head injuries, and it contains many excellent illustrations, a valuable bibliography, and much useful statistical data. Under the able editorship of Mr H. J. Seddon, the subject is handled in five sections, and deals with treatment in forward areas, and the management of injuries involving bones, joints, peripheral nerves, and peripheral arteries.

There is no hint of smugness in these expositions; yet, throughout, the reader is aware of the very considerable progress made over the methods and results of the First World War. The Winnett-Orr technique, developed and extended in the Spanish Civil War, was thoroughly proven, and stood the test of the many varying conditions of the Second World War. The impact of chemotherapy, and in particular of penicillin, on the management of wounds is here well described. The initial enthusiasm for this method of treatment, with facile abandonment of surgical principles, was followed by the rapid realization that chemotherapy was but an aid to, rather than a substitute for, early and thorough surgical treatment. The better control of infection, together with early ambulation, more intensive rehabilitation, and the energetic use of such time-savers as early skin-grafting, all contributed to a greatly diminished period of hospitalization, and to a quicker return to full duty—the prime aim of a military surgeon. Vascular surgery benefited from segregation into special units, but the introduction of anticoagulants, which have so widened the possibilities of reconstructive arterial surgery, came too late to help in the management of war injuries.

It is a melancholy thought that all the valuable experience herein set down may be of little use to surgeons in a future conflict, in which wounds from missiles may seem very insignificant compared with new varieties of trauma from heat and radioactivity.

J. P. Bentley

## 1576 Ulcers and Eczema of the Leg: Sequels of Phlebitis, etc. Studies on Static Diseases of the Lower Limbs and their Treatment

Holger Bisgaard. Copenhagen: Einar Munksgaard, 1948. 111 pages; 36 figures. 25 x 16 cm. 15 Dan. kr.

Introduction. (i) Uncomplicated cases of infiltration; (ii) infiltrations and varicose veins; (iii) infiltrations and phlebitis; (iv) infiltrations and thrombophlebitis; (v) infiltrations and ulcers of the leg; (vi) infiltrations and eczema of the leg; (vii) infiltrations complicated by the deformity: "three star" cases; (viii) infiltrations complicated by the deformity crura quadrata; (ix) infiltrations and arthrosis deformans; (x) infiltrations in the most severe and last stage.

Dr Bisgaard's approach to the problems resulting from man's adoption of the erect posture was both stimulating and original. Until his recent death, Bisgaard worked as a general practitioner in Denmark, so that his methods of treatment of ulcers, eczema, and

oedemas of the legs were basically empirical. They, nevertheless, proved so successful in practice that they came to be employed in the State Hospital in Copenhagen, and earned the praise and support of Professor Haxthausen himself.

Bisgaard's thesis is briefly this: that a great deal of disability from pain, swelling, heaviness, and fatigue in the distal part of the legs arises from filtration oedema. This oedema, which Bisgaard calls an infiltration, may have a central or peripheral cause, but is itself responsible for many crippling sequelae. Thus, whilst he acknowledges that varicose veins are a common cause of infiltration, he lists many other causes as common, such as anaemia, heart disease, postoperative debility, and pregnancy, and, locally, fractures and phlebitis. He goes on to assert that the infiltration often persists for a long time after the causative factor has itself disappeared. Thus infiltration, from being a symptom, may become a disease.

Infiltration is recognized principally by a painful and tender puffiness in the malleolo-calcaneal spaces, especially on the inner side, and what Bisgaard calls the pathognomonic symptom is local pain and restlessness at night, relieved by movement. Bisgaard's treatment is meticulously described; it aims at dispersing the infiltration in three ways, by massage, by elastic bandaging, and by mobilization. Progress is assessed by repeated measurements of diameter at three levels in the leg. The latter part of the book contains case reports of cases of simple and complicated infiltrations, showing the benefit derived in each by the application of Bisgaard's methods of treatment.

Most workers in this country will probably feel that perhaps too much emphasis has been placed by Bisgaard upon this secondary phenomenon of infiltration, and that, in almost every case, appropriate treatment of the causative lesion will itself lead to the disappearance of the infiltration. In those cases, of course, in which infiltration is present without any treatable primary cause, elastic support has usually been resorted to. It is most valuable, however, to have Bisgaard's detailed instructions on how best to apply elastic support, and also to learn of the reliance he has placed on an exact technique of massage.

J. P. Bentley

## 1577 Varicose Veins

R. Rowden Foote. London: Butterworth & Co. Ltd., 1949. xiv + 226 pages; 181 figures. 2 coloured plates. 25 x 17 cm. £1 12s. 6d. [£1.625]

(i) Some historical landmarks in the treatment of varicose veins; (ii) anatomy, physiology and pathology; (iii) incidence and aetiology of varices; (iv) the investigation of the patient with varicose veins; (v) treatment; (vi) varicose ulceration; (vii) thrombophlebitis and pulmonary embolism; (viii) anticoagulant therapy; (ix) the supportive and compression treatment in varicose conditions; (x) the varicose vein clinic and some useful prescriptions; (xi) the recent work in varicose veins. Appendix A. Index.

Mr Rowden Foote is to be heartily congratulated on the high quality of this book, the first dealing solely with varicose veins to be published in Great Britain. The author rightly stresses the immense importance of varicose veins and their complications, in the life and work of the community, and reminds us of the astounding fact that during the last war varicose veins constituted the largest single group of admissions to hospitals in the Emergency Medical Service, accounting for almost 10% of all cases! The book covers the whole subject most comprehensively, starting with a historical survey, and passing through the etiology and pathology to a consideration of the various methods of treatment in vogue today.

His own preference for most cases is for a high ligation flush with the femoral vein, coupled with the distal injection of a phenol-glycerin-glucose solution through a "nutmeg-grater" needle by means of which mechanical, as well as chemical, trauma is applied to the tunica intima. This technique is said to give almost universally excellent results, though the theoretical objection remains that sclerosants injected into the thigh pass immediately into the deep venous system, as shown by Boyd and others in phlebographic studies. It might therefore seem possible for deep femoral thrombosis to be at any rate an occasional complication of this method of treatment. It would indeed be illuminating, also, if histological proof were available that the technique definitely avoided the incidence of recanalization of the internal saphenous vein after months or years. This is a crucial point. Bull and Hiatt of Columbia University, New York, believe that no method of treatment will prevent recanalization of the vein, and they have, in consequence, reverted to the old technique of total extirpation of the vein, using the Mayo vein stripper. They argue that every other method leads



to recanalization, with a thick-walled rigid vein and damaged valves, which, though not varicose, nevertheless causes venous back-pressure on distal areas, with all its attendant ills.

The whole book is splendidly and copiously illustrated, mostly with actual photographs, and detailed advice is given on many useful manoeuvres, from the application of a supportive bandage to the still insufficiently practised empty vein technique for the injection of sclerosants. There is also a most useful section dealing with the problems of thrombophlebitis and embolism, and anticoagulant therapy.

Throughout the book the author has made a praiseworthy and successful attempt to present the views of others as well as his own on this very controversial subject. Whilst indicating at each stage his own preferences, supported by cogent reasons, he has avoided the tendency to bigotry and dogma which so often characterizes utterances of those who have concentrated their interests on a relatively narrow and circumscribed field. In general, this book can be highly recommended to both surgeons and general practitioners, and is likely to become the standard work on the subject for some time to come.

J. P. Bentley

## 1578 Modern Practice in Ophthalmology, 1949

Edited by H. B. Stallard. London: Butterworth & Co. Ltd., 1949. xx + 525 pages; 231 illustrations; 30 colour plates. 25 x 17 cm. £3 5s. [£3.25]

(i) Anatomy and physiology; (ii) pathology; (iii) medical ophthalmology; (iv) methods of examination; (v) ocular therapeutics; (vi) diseases of the eyelids; (vii) diseases of the lacrimal apparatus; (viii) diseases of the conjunctiva; (ix) diseases of the cornea and sclera; (x) diseases of the uveal tract; (xi) diseases of the retina; (xii) diseases of the optic nerve; (xiii) diseases of the vitreous body; (xiv) diseases of the lens; (xv) glaucoma; (xvi) refractive errors; (xvii) strabismus and heterophoria; (xviii) injuries of the eye; (xix) diseases of the orbit; (xx) tropical ophthalmology; (xxi) surgical operations on the eye, eyelids and orbit. Appendix: standards of vision for the Services, etc. Index.

This book is written for the general practitioner, with the aim of providing him with a practical outline of modern ophthalmic practice, so that he may be able to share with the specialist the responsibility of treatment of ophthalmic cases or to deal with them efficiently in the absence of specialist help. This difficult task has been undertaken by a team of specialists who may be said to have achieved the first purpose of the book but to have fallen short, in some respects, of the second.

The first five chapters deal with general topics—atomy and physiology, pathology, medical ophthalmology, methods of examination and general therapeutics. These are for the most part excellent, covering wide fields concisely and clearly. Then follow chapters on diseases of each of the structures of the eye in turn. Those on the lids, the conjunctiva and the retina are instructive and straightforward. The others, one feels, fail as guides to the uninformed by not being sufficiently schematic and dogmatic. The chapter on the cornea, for example, though interesting and unusual in its approach, leaves one groping for the signs, symptoms and treatment of, say, a hypopyon ulcer. In the chapter on glaucoma also, though all the information is there, the clinical pictures are not sufficiently clearly defined and no sharp distinction is made between acute and chronic types. The chapter on refractive errors is most comprehensive and instructive and that on strabismus and heterophoria could hardly be better. There is also a useful short chapter on tropical ophthalmology. The final chapter on operations is well illustrated but hardly realistic in some respects. Illustrated details of emergency operations, rather than of such operations as conjunctivo-dacryocystostomy or recession of the inferior oblique, would be of value to the practitioner in remote districts. There is a useful appendix on visual standards required for various Services.

A chapter on ophthalmic symptoms in general would have been a valuable addition and one's general impression is that the book might have been given more of a "vade-mecum" character without losing in attractiveness.

A. Lister

## 1579 The Science and Art of Joint Manipulation. Vol. I. The Extremities

James Mennell. Second edition. London: J. & A. Churchill Ltd., 1949. xv + 215 pages; 299 figures. 25 x 19 cm. £1 4s. [£1.2]

Part I. General considerations. (i) Introduction; (ii) the joint lesion; (iii) referred pain; (iv) general rules for manipulation. Part II. The joints of the upper extremity. (v) The digital joints; (vi) the metacarpal joints; (vii) the

wrist region; (viii) the radio-ulnar joints; (ix) the elbow; (x) the shoulder joint; (xi) the clavicular joints. Part III. The joints of the lower extremity. (xii) The digital joints; (xiii) the metatarsal joints; (xiv) the tarsal joints; (xv) the ankle region; (xvi) the knee region; (xvii) the hip joint. Index.

Of the three standard works on manipulation by British authors, this is the most exhaustive. It comes from the pen of the doyen of physicians practising manipulation, and summarizes the results of many years' experience.

General considerations include subluxation and adhesion-formation at joints, together with the bearing of the shape of the articular surfaces on function. This aspect of applied anatomy runs through the whole volume and is admirably set out. Referred pain is considered next, with emphasis on the segmental distribution of symptoms arising from spinal lesions. The next chapter deals with the principles governing manipulation, but the indications for and against forcing movement might well have been set out in greater detail. Caution is wisely enjoined and the reader learns that the history, the amount of movement present at the joint, and the x-ray appearances must be considered; but this important section on the nature and evaluation of these and other clinical signs could well have been expanded further. The present-day tendency to rely too much on the radiograph and to neglect clinical signs is justly criticized.

The joints of the extremities are considered each in turn. The shape of the bony facets is correlated with the separate patterns of movement achieved voluntarily and passively. The influence of joint-contour on the manner of performing a manipulation always receives masterly exposition, and there are textual descriptions and illustrations of as many as ten or twenty different ways of manipulating one joint, so that not only is a full range obtained of those movements which can be carried out by active effort, but a number of movements not capable of voluntary performance are also achieved. The elbow is dealt with in unorthodox fashion. The chapter on the hip joint is wholly admirable.

This book provides a fund of information for the clinician experienced in the diagnosis and treatment of the disorders met with in manipulative practice. Whoever wishes to study dynamic articular anatomy in its relationship to the manner of manipulating joints will enjoy every page of this important work.

J. Cyriax

## 1580 Structure and Function as Seen in the Foot

Frederic Wood Jones. Second edition. London: Baillière, Tindall & Cox, 1949. viii + 333 pages; 155 figures. 22 x 14 cm. £1 5s. [£1.25]

(i) Introductory, dealing with the study of the foot; (ii) the principles of terminology; (iii) the human foot in phylogeny; (iv) the foot in ontogeny; (v) digital formula; (vi) metatarsal formula; (vii) external characters; (viii) the fascias; (ix) the bones; (x) the accessory bones; (xi) the sesamoid bones; (xii) the joints; (xiii) the extrinsic muscles; (xiv) the morphology of the extrinsic muscles; (xv) the intrinsic muscles; (xvi) the morphology of the intrinsic muscles; (xvii) the actions of the muscles; (xviii) the movements of adduction, abduction and opposition of digits; (xix) the movements of flexion and extension of the toes; (xx) tendons, tendon sheaths and bursae; (xxi) the arches of the foot; (xxii) the foot and the brain; (xxiii) the sensory nerves; (xxiv) the motor nerves; (xxv) the vascular channels. Index.

Over a quarter of a century ago Professor Wood Jones produced a rather novel anatomical book entitled *Principles of anatomy as seen in the hand*, in which the detailed anatomy of the hand was used as a text for generalizations on anatomical principles. This book deservedly became very popular and the author has recently written a companion volume, *Structure and function as seen in the foot*, now in its 2nd edition, which follows the same lines and is equally fascinating to read, although in view of the earlier treatise general principles have been described in less detail, while the special principles displayed in the structure and function of the foot have received more attention. This is no dull academic textbook describing structures on conventional lines, but a living anatomy from which we may not only learn the form, position, variations, morphology and functions of bones, muscles, joints and so on, but also may come to see the why and how. As an example of the particular method of presentation we may take the chapter on the vascular channels where it is shown how these vary from animal to animal depending upon such factors as the torsion of the limbs and their usual posture in use.

It is a sad commentary on the many conferences which have been held on anatomical nomenclature that the author has found it necessary to include a chapter, "The principles of terminology", in which he suggests the use of such terms as "pre-axial" and "post-axial" in place of the more usual medial and lateral, to avoid



ambiguity. Nevertheless he has been unable to avoid such clumsy expressions as "the fibular-sided head of the bicipital flexor hallucis brevis".

The physical anthropologist will find much useful information and much of interest in the chapters on digital and metatarsal formulae, and on the external characters of the foot (see Chapters V, VI and VII).

In Chapters III and IV there is a good discussion of phylogeny and ontogeny in their relationship to the origin of the human characteristics of the foot. As is well known, Professor Wood Jones holds some original and rather unorthodox views on the evolution of man and he has used many features in the development and structure of the foot as support for his general theory that the human foot is derived from a primitive mammalian foot. This part of the work is highly controversial and will undoubtedly be provocative. The author is particularly critical of what he terms the "gorilloid theory" of the evolution of man. "Those who look upon Man as being derived from a 'gorilloid' stock see human foot structures as being direct developments from those present in the Gorilla. Those who derive Man from an earlier stock, from which the giant apes also arose, see, in the Gorilla foot, an inception of some of those specialisations already achieved in Man". But it is only fair to point out that two of the authors whom he particularly picks out for criticism (Morton, D. J., *The human foot*; Lake, N., *The foot*) use the resemblances between the feet of gorilla and man precisely in this latter sense, i.e., as indicating the structural changes at the inception of the adaptation of the foot for bipedal progression; indeed, the author confesses that Morton's description of the forerunner of man as a relatively small-sized active and agile animal of erect posture is so unlike a gorilla that the term "gorilloid" would seem wrongly bestowed. Evidently the use of the word "gorilloid" is the "nigger in the wood pile". Nevertheless it is proper to take a very broad view and to remember that apart from the foot there are other close resemblances between man and the large anthropoids which cannot be overlooked, such as blood-groups, precipitin reactions, and menstrual cycles, which seem to indicate that our relationship is a very close one indeed. The two opposing schools of thought approach the matter from opposite view-points, the one emphasizing the resemblances, the other the differences; this book records the latter attitude.

In dealing with ontogeny the author, correctly, in our view, states that the recapitulation theory is no more than a useful guiding principle and that it has largely lost its reputation for infallibility. However, if this is so, we can scarcely pay much attention to the statement that the internal cuneiform even in its earliest developmental stages shows no gorilloid characteristics in the distal joint surface, so that "be ancestral history what it may, it cannot be claimed that there is any embryological evidence that the ancestral human hallux was opposable, though it was doubtless divergent"; this would seem to involve the direct application of the recapitulation theory to a very small detail, and that, as the author himself says earlier, would "reduce this so-called law to absurdity".

The comparative anatomy of the musculature of the foot is very well done but it is doubtful whether the writer's list of "features in which the muscles of the human foot show a plan more primitive than that existing in any monkey" would be accepted by some competent comparative anatomists.

Perhaps the most satisfactory summing up of the present position is by W. Straus: "In its musculature as in its skeleton and outer form the foot of the gorilla more closely approaches that of man than does the foot of any other primate. But at the present time it is difficult to decide which of these similarities are indications of close genetic relationships and which are merely due to convergence produced by interaction of environmental forces and an ancient ground plan".

The question of the development of the arches of the foot is a very controversial one and it is interesting to record that Wood Jones does not entirely subscribe to the modern orthopaedic teaching that the arches are transient postural structures; he reinstates the ligaments in their important function of controlling the general form of the arch which itself is nevertheless "plastic and mobile" and capable of depression by body-weight and elevation by muscle action. This is a middle position between the extreme schools of thought on the subject and is probably correct.

Except for one or two small points the 2nd edition of this work is the same as the 1st. The book is full of interest and provocation; it is truly educative and stimulating and for these reasons can be highly recommended. There are a large number of line drawings by the author himself; their anatomical accuracy is thus assured and they clearly illustrate the arguments of the text.

Norman C. Lake

## OBSTETRICS AND GYNAECOLOGY

## 1581 A Synopsis of Obstetrics and Gynaecology

Aleck W. Bourne. Tenth edition. Bristol: John Wright & Sons Ltd., 1949. vii + 522 pages; 167 illustrations. 19 x 13 cm. £1 1s. [£1.05]

Part I. A synopsis of obstetrics. Section I. Normal pregnancy. (i) The ovum, fertilization, and early development; (ii) chorion, amnion, placenta, umbilical cord, and foetus; (iii) changes in the maternal organism; (iv) diagnosis of pregnancy; (v) duration and management of pregnancy. Ante-natal care and examination. Section II. Abnormal pregnancy. (vi) Auto-intoxications; (vii) abnormalities of the generative tract; (viii) diseases of the ovum; (ix) ectopic gestation; (x) abortion; (xi) associated disorders. Section III. Normal labour. (xii) Physiology and course of labour; (xiii) mechanism of normal labour; (xiv) management of normal labour. Section IV. Abnormal labour. (xv) Occipito-posterior positions; (xvi) face and brow presentations; (xvii) pelvic presentations; (xviii) transverse positions; (xix) prolapse of cord and limbs. Twins; (xx) contracted pelvis; (xxi) difficult labour due to abnormalities of soft parts; (xxii) anomalies of uterine action; (xxiii) maternal injuries; (xxiv) ante-partum haemorrhage; (xxv) post-partum haemorrhage. Section V. The puerperium and the new-born child. (xxvi) Physiology and management of puerperal state; (xxvii) puerperal infection; (xxviii) sudden death and miscellaneous disorders in the puerperium; (xxix) the new-born child; (xxx) post-natal examination and care. Section VI. Obstetric surgery. (xxxi) Forceps; (xxxii) version; (xxxiii) induction of labour and abortion; (xxxiv) craniotomy—cleidotomy—evisceration—decapitation; (xxxv) caesarean section—symphysiotomy—pubiotomy. Part II. A synopsis of gynaecology. (xxxvi) Anatomy; (xxxvii) development and malformations of the genital organs; (xxxviii) sex hormones—menstruation—puberty—the menopause; (xxxix) amenorrhoea—menorrhagia—metrorrhagia; (xl) dysmenorrhoea; (xli) leucorrhoea; (xlii) infections of vulva and vagina; (xliii) infections of cervix and corpus uteri; (xliv) infections of Fallopian tubes, ovaries and pelvic peritoneum; (xlv) gonorrhoea; (xlvi) new growths and miscellaneous affections of the vulva; (xlvii) new growths, cysts, and fistulae of the vagina; (xlviii) fibromyomata; (xlix) malignant disease of the uterus; (l) ovarian and parovarian tumours; (li) displacements of the uterus; (lii) vaginismus, dyspareunia, and sterility; (liii) disorders of micturition. Index.

A specialist may be tempted to turn up his nose at a "synopsis" in his own subject. Any such tendency on the part of this reviewer was counteracted by the recollection of how he himself had often had hurried but beneficial recourse to a well-known synopsis of medicine, and by the thought that a synopsis of obstetrics and gynaecology could not be in better hands than those of a man of such proved independence of thought and judgement as Mr Bourne. He had to read no further than the preface to get confirmation of his view in the refreshing statement that the author had tried to suppress "out-dated ideas and methods, though the 'fixing' of teaching by the demands of examiners has prevented the deletion of some matter which has little relation to modern theory and practice."

In reviewing this little volume one has to keep ever in mind the narrow and irksome limits within which the author has had to work; and the same applies to the thumb-nail type of illustration which seems to be all that is admissible within the limits of a synopsis. Nor may the peculiar needs of the prospective readers be overlooked. It is not hard to detect some of the dead wood which Mr Bourne rightly regards as dear to the hearts of some examiners; and while the eradication of it from the synopsis would not uproot it from their minds, yet its retention here, as in any other widely-read book, merely tends to give its roots stronger attachment.

In view of the author's difficulties and of the fact that this is clearly not the type of book in which to stress individual views, we refrain from any detailed comment, but we must admire the masterly way in which the great mass of material has been handled. If one may parody Goldsmith's familiar couplet on the village schoolmaster, still the wonder grows how one small book can carry such a vast content of information.

The book is intended for rapid revisal of the subject by the student examinee, or for quick consultation on individual points by the busy practitioner. In both capacities it may be commended as a thoroughly reliable guide.

R. W. Johnstone

## 1582 The Anatomy of the Female Pelvis

F. A. Maguire. Fourth edition. London: Angus & Robertson, 1949. xv + 176 pages; 55 figures. 23 x 15 cm. £2 2s. [£2.1]

(i) The pelvic wall; (ii) muscles of the pelvis; (iii) pelvic fascia; (iv) the urogenital diaphragm; (v) the vulva; (vi) the pelvic viscera in general; (vii) the pelvic peritoneum; (viii) the pelvic connective tissue; (ix) pelvic blood-vessels and lymphatics; (x) the supports of the uterus; (xi) the uterus; (xii) the uterine (Fallopian) tubes; (xiii) the ovaries; (xiv) the vagina; (xv) the genital organs before, during, and after the reproductive epoch of life; (xvi) the struc-

tures between the layers of the broad ligament; (xvii) the lower urinary passages; (xviii) the lower bowel; (xix) the ischio-rectal fossa; (xx) applied anatomy; (xxi) the physical examination. Index.

It is close upon a decade since the previous edition of this little book was issued (the author being, in the interval, on active service) and it may not be as familiar as it deserves to be amongst present-day students.

Dr Maguire has the double qualification for writing such a book in that before advancing into gynaecology he was for six years the Professor of Anatomy in the University of Sydney. Perusal reveals a third qualification of no less importance—that he is obviously a man with a natural aptitude for teaching. Consequently his book offers a singularly clear and comprehensive account of its subject, with what one may call "teaching points" skilfully emphasized, particularly those with any special bearing upon either the design or the performance of gynaecological operations. It is, therefore, a book that should be most helpful to students of all grades of seniority who are preparing for examination in anatomy or in gynaecology, and not less so to those engaged in gynaecological operating or teaching. One of the best chapters is the last—on the physical examination of the pelvis in the living subject—where the clinical and scientific experience of the author is gathered up and blended in simple, clear instructions.

Sir William Fletcher Shaw has contributed a foreword in which he traces the evolution of those plastic operations on the female pelvic floor which form such a distinctive feature of modern gynaecology and for which we owe so great a debt to British gynaecologists and to the Manchester School in particular.

With 55 illustrations, semi-diagrammatic certainly, but beautifully drawn and admirably reproduced on art paper, this must have been an expensive book to produce, and both author and publishers are to be congratulated. One can only hope that medical students of today are more affluent than they were when an appreciative reviewer had the pleasure of being one of their number.

R. W. Johnstone

## 1583 Atlas of Mahfouz's Obstetric and Gynaecological Museum. Volume I

Noguib Pacha Mahfouz. Altrincham: John Sherratt & Son, 1949. xviii + 417 pages; 219 figures. 25 x 19 cm. £9 9s. the set of 3 volumes [£9.45]

(i) Structure of the genital organs: malformations of the female genital organs; (ii) the supporting structures of the genital organs: prolapse of the pelvic organs; (iii) menstruation and its functional disturbance; (iv) the pituitary gland during pregnancy; (v) the formation of the placenta: diseases of the membranes and placenta; (vi) disorders of pregnancy; (vii) hydatidiform degeneration of chorion: chorion-epithelioma; (viii) antepartum haemorrhage; (ix) the toxæmias of pregnancy; (x) the accidents of labour.

Few men can have had a richer experience or a more fruitful territory from which to derive a vast collection of pathological material than Mahfouz Pacha. Not only has he collected a unique museum of obstetrical, gynaecological and neonatal pathology, but his friends and colleagues have all lent a hand in swelling the total. There can be no museum in Britain which approaches this one.

It is therefore right and timely that a catalogue and atlas of his specimens should be published, and this very considerable work will appear in three volumes, the first of which is now available to the public. The production of this atlas must have given the author an immense amount of labour, for the book has obviously been compiled with meticulous attention to detail.

The author's plan has been to subdivide his subject into chapters, each of which starts with a short introduction. Although this is short, it is extremely succinct and contains more meat in a few lines than many a textbook in several pages. Mahfouz has rigorously excluded anything that is experimental, hypothetical and untried, and has steadfastly kept to the orthodox. In this way he may perhaps be criticized in certain places for being a little old-fashioned, but I think that, on the whole, this is a good trait in a book which will have a wide appeal to students. After the preamble there follows the series of illustrations in black and white, and in colour, relevant to the subject under discussion, each with a small sub-title in seven languages—French, German, Italian, Spanish, English, Arabic and Russian. These illustrations are superbly reproduced and the artist is to be congratulated. The histology is well reproduced.

It is difficult to pick out the best chapters in a book of a standard so uniformly good, but the chapters on the uterus and on hydatidiform mole and chorionepithelioma are outstanding. In fact, the latter is the best I can remember even in a textbook of gynaecology; and Mahfouz's *Atlas* is not a textbook.

There are few criticisms to be made about this book, but one or two points should be noted. First, there is a number of unfortunate spelling mistakes; the author should have his proofs read for the next edition by a classical scholar. It would also be an improvement to the next edition to have the names of those authors who are mentioned in the text tabulated for reference at the end of the chapter, so that the more advanced student would be able to explore the subject further should he wish to do so. This reviewer thinks it is a pity that a book which is going to have a wide appeal to the less opulent medical student should not be sold in separate volumes at 3 guineas each; to subscribe nine guineas for three volumes, two of which may not be delivered for several months, will deter a number of would-be purchasers.

Finally, every medical library and every medical school in the world should certainly have a copy of this *Atlas*. It will be of equal interest to teacher, specialist and student of the humblest qualifying examination. It bears the stamp of genius and is a monument to the unique experience of a man who has had one of the biggest gynaecological practices in the world.

J. Howkins

### 1584 *Lehrbuch der Gynäkologie*

Edited by Hans Guggisberg. Second edition. Basle: S. Karger, 1947. xlii + 717 pages; 354 illustrations. 25 × 17 cm. 72 Sw. fr.

(i) Anatomie des weiblichen Genitalapparates und seiner Nachbarorgane; (ii) die Entwicklung des weiblichen Urogenitalapparates; (iii) die Entwicklungsstörungen der Geschlechtsorgane; (iv) die Konstitution der Frau; (v) Konstitutions- und Wachstumsstörungen; (vi) die Physiologie der Frau; (vii) die Funktionsstörungen und die krankhaften Erscheinungen des weiblichen Genitale; (viii) Pathogenese der organischen und funktionellen Genitalleiden; (ix) die gynäkologische Diagnostik; (x) die Erkrankungen des äusseren weiblichen Genitale; (xi) die Erkrankungen der Vagina; (xii) die Erkrankungen des Uterus; (xiii) die Krankheiten der Ovarien; (xiv) die Erkrankungen der Tube; (xv) die Erkrankungen des Beckenbindegewebes und des Bauchfells; (xvi) die Erkrankungen der Bauchdecken; (xvii) die Erkrankungen des Darmes und ihre Beziehungen zum weiblichen Genitale; (xviii) die Erkrankungen der Harnorgane; (xix) die Infektion der Genitalorgane; (xx) Lage- und Gestaltveränderungen der Genitalorgane; (xxi) die Endometriosen; (xxii) die Sterilität; (xxiii) die Kontrazeption; (xxiv) die Therapie mit körpereigenen Wirkstoffen; (xxv) die physikalische Therapie; (xxvi) die Strahlentherapie; (xxvii) Diätetik (die therapeutische Verwendung der Vitamine); (xxviii) Hygiene der Frau. Sachregister.

### *Lehrbuch der Geburtshilfe. Vols. I and II*

Edited by Th. Koller. Basle: S. Karger, 1948. xxiv + 1323 pages; 711 figures. 25 × 17 cm. 110 Sw. fr. the set of two volumes

Vol. I. (i) Geschichtlicher Überblick über die Entwicklung der Geburtshilfe; (ii) Embryologie des Menschen und Morphologie des Neugeborenen; (iii) die normale Schwangerschaft inklusive Schwangerschaftshygiene und Schwangerenfürsorge; (iv) die normale Geburt; (v) das physiologische Wochenbett (Puerperium); (vi) Physiologie des Neugeborenen; (vii) Mehrlingsschwangerschaft und Geburt; (viii) die Geburt aus Beckenendlage; (ix) die Pathologie der Schwangerschaft; (x) die Extrauterin gravidität. Vol. II. (xi) Die regelwidrige Geburt; (xii) das pathologische Wochenbett; (xiii) die Missbildungen des Feten; (xiv) Pathologie des Neugeborenen. Sachregister.

This three-volume work comprehensively describes present-day Swiss teaching in obstetrics and gynaecology. The editors felt that such a work was more than ever necessary because of the non-appearance of German-language textbooks in these fields due to the recent war. The fact that a 2nd edition of vol. I was required within a few months of the publication of the 1st indicates the soundness of this judgement.

The first section of vol. I, *Lehrbuch der Gynäkologie*, deals with the anatomy of the female reproductive organs and is profusely illustrated. Unfortunately, many of these illustrations lack clarity, and perhaps might have been differently chosen with advantage. For example, the relationship between the ureter and the uterine artery is described in the text, but is not illustrated. There follow chapters dealing with the embryology and physiology of the female sex organs. Functional abnormalities are well documented and the medical, surgical and radiological treatment of these is fully considered.

The chapter on gynaecological diagnosis is up to date and present-day methods are fully described. The chapter on the pathology of the external genitalia is noteworthy because of its excellent coloured drawings, a contrast to the illustrations which appear earlier in the book. Noteworthy also is the fullness of treatment of myomata of the uterus.

Two volumes are devoted to obstetrics, titled vols. I and II, though listed as vols. II and III in the series. The chapters on normal pregnancy and labour are fairly full, though perhaps more stress might have been laid on the value and routine of antenatal care. The sections on the diseases of pregnancy and the pathology of labour and the puerperium are comprehensive and include a chapter on the pathology of the breast.

This work has been written by authors of great experience; it is perhaps a little too full for the undergraduate student, but will prove a trustworthy and valuable help to the postgraduate student and a useful reference volume to the specialist.

Oskar Burger

## NEUROLOGY AND PSYCHIATRY

## 1585 International Congress on Mental Health, London 1948, Vols. 1, 2, 3 &amp; 4

Edited by J. C. Flugel. London : H. K. Lewis & Co. Ltd. ; New York : Columbia University Press [1949]. Vol. I : History, development and organisation. 154 pages ; illustrations. 22 x 15 cm. 10s. [£0.5]. Vol. II : Proceedings of the International Conference on Child Psychiatry, 11th-14th August. xiii + 142 pages. 22 x 15 cm. 10s. [£0.5]. Vol. III : Proceedings of the International Conference on Medical Psychotherapy, 11th-14th August. xv + 129 pages. 22 x 15 cm. 10s. [£0.5]. Vol. IV : Proceedings of the International Conference on Mental Hygiene, 16th-21st August. ix + 330 pages. 22 x 15 cm. £1

Vol. I : (i) Origins and aims of the Congress ; (ii) development of the programme ; (iii) group work before and during the Congress ; (iv) United States participation ; (v) the International Preparatory Commission ; (vi) press and publicity ; (vii) organisation. Vol. II : (i) Aggression in relation to emotional development, normal and pathological ; (ii) aggression in relation to family life ; (iii) psychiatric problems in the educational sphere ; (iv) the community and the aggressive child. Vol. III : (i) The genesis of guilt ; (ii) guilt and dynamics of psychological disorder in the individual ; (iii) collective guilt ; (iv) advances in group and individual therapy. Vol. IV : (i) Problems of world citizenship and good group relations ; (ii) the individual and society ; (iii) family problems and psychological disturbance ; (iv) mental health in industry and industrial relations ; (v) planning for mental health : organisation, training, propaganda ; (vi) conclusions and recommendations.

The 1948 International Congress on Mental Health, held in London under the presidency of Dr J. R. Rees, was not only one of the largest gatherings of its kind, but was conceived as an experiment in trans-national and inter-disciplinary communication. The first volume of its Proceedings deals with the steps taken to secure this end, and with the analysis of mistakes for those who come after. In this, the writers are perhaps hard on themselves as planners of the Congress. The feat of arousing some 4,000 persons, in many instances leaders in the field, from 28 different professions in 20 countries, to serious preparatory group discussions, fact-finding and even original research, some 18 months before the actual Congress, is probably unprecedented, and possibly the most significant among the achievements of this gathering.

In order to appreciate the material in the other three volumes it is essential to keep in mind that the Congress aimed less at individual brilliance than at finding the areas of agreement and disagreement among the disciplines concerned with promoting the purposes of a good society. Hearing and re-reading the statements from eminent psychiatrists, psychologists, social scientists and so forth, one is astonished at the rapidity with which their concepts, and even their language, have converged in the last decade. The cross-fertilization between disciplines, resulting from preparatory groups and from the efforts of individuals who had achieved considerable integration of psychological and sociological thinking, is evidenced in many papers and less formal contributions. Psychiatrists have begun to think socially and social scientists psychiatrically. A new science of "human relations" or "sociatry" is being born.

The Congress was a fusion of three conferences : on child psychiatry, on medical psychotherapy, and on mental hygiene, separately sponsored. Thanks to co-ordination, the major topics of each fitted into the theme of the whole : "Mental health and world citizenship". It is permissible to paraphrase the handling of this large subject by the Congress as "The study, diagnosis, therapy and prevention of the development of unhealthy or dangerous tensions within individuals, between individuals, within groups and between groups". Nearly half the published material consists of reports of the views of representative groups concerning such matters as aggression, guilt and their bearing on human relations. Among these expressions of common purpose and doctrine there are stimulating and profound discourses by distinguished leaders in the fields of psychiatry and social science. Margaret Mead, Franz Alexander, William Line, L. K. Frank, Anna Freud, T. F. Rodger and J. C. Flugel seem to stand out in this galaxy. The contents of these volumes, therefore, not only deal with recent work but are also authoritative and will repay careful study by any worker, whether concerned with individual welfare or with public hygiene, administration or policy.

This is perhaps especially the case with a succinct statement of basic concepts and practical recommendations for prophylactic

action, prepared by a small, picked group of persons representing various countries and disciplines meeting for some weeks before the Congress—the so-called International Preparatory Commission (Vol. IV, p. 285 *et seq.*). The statement is a condensed but readable digest of current views and trends on a canvas sufficiently broad to be applicable to countries at all stages of mental health service development. Recommendations are grouped under the headings of "Principles underlying the practice of mental health", "Planning and organisation of national mental health services", "Education of the general public", "Education of specialists", and "Research". Recommendations for international action are addressed to the United Nations, the World Health Organization, and other specialized agencies. This statement was adopted with virtual unanimity by the Congress as a whole.

The main conclusions point to an acceptance of human nature as plastic, dynamic and capable of exhibiting an infinity of behaviour patterns ; it is therefore capable of change and not predetermined. It is social habit or institution that is resistant to change. This offers a message of reasonable hope in our power to influence changes in such patterns by social, medical and educational action. The recommendations show that neither psychiatry, nor any other single discipline, has any illusions or grandiose fantasies about its powers to heal a distracted world. What emerges is a sober design for constructive assistance ; mental health workers must broaden their conception of their work to include the total human situation rather than wait for patients to flood their clinics. The statement is a challenge to social policy. The front line of the battle for mental health lies in the education of parents, teachers, public health and infant welfare workers, and above all of policy makers and leaders of men, in the understanding of human beings, as individuals and in their social units, as ascertained by adequate scientific study.

The work accomplished by the Congress bids fair to cut the last bit of ground from under those who would still wish to maintain that the human sciences are nothing but warring camps and that medicine or classical economics can afford to ignore their teaching and their claim to contribute to human welfare. It is made clear that the World Health Organization and UNESCO have both officially signified their acceptance of the Congress recommendations and have conferred recognition on the World Federation of Mental Health founded during the Congress. One wishes these proceedings could be made obligatory reading in all postgraduate schools of medicine and of social science. The volumes are adequately produced and edited.

H. V. Dicks

## 1586 The Trend of Scottish Intelligence. A Comparison of the 1947 and 1932 Surveys of the Intelligence of Eleven-Year-Old Pupils

Sponsored by the Population Investigation Committee & the Scottish Council for Research in Education. London : University of London Press Ltd., 1949. xxviii + 151 pages ; 7 figures. 22 x 14 cm. 7s. 6d. [£0.375]

(i) Introduction ; (ii) administrative arrangements ; (iii) sociological inquiry ; (iv) individual testing ; (v) correction of scripts and coding of sociological schedules ; (vi) results of group test ; (vii) intelligence and family size ; (viii) comparison of the 1947 and 1932 individual test results ; (ix) the implications of the 1947 survey.

At the beginning of the present century, fears were repeatedly expressed lest the alleged differences in fertility between the different social classes might not be producing a decline in the national intelligence.<sup>1</sup> The first actual surveys of intelligence, carried out by means of standardized tests, were those commenced in 1913 by Burt as Psychologist to the London County Council schools. The results revealed a small but undeniable negative correlation between children's intelligence and the size of the families from which they came. It was also shown that the correlation within each social class was quite as marked as the correlation with class differences ; in fact, class differences as such proved a somewhat irrelevant factor.

<sup>1</sup> See also *Brit. med. Bull.* 1947, Vol. 5, pages 226 & 228.—Ed.

The decline in average intelligence suggested by the figures was too small to be distinctly observable over a short period of time, particularly in an area like London with its shifting population. On the other hand, if no other factors were operative, the changes at the extreme ends of the scale, in the number of defectives and of scholarship children respectively, ought to have been discernible in the course of 10 or 20 years. But neither subsequent surveys nor the observations of teachers, school medical officers, or scholarship examiners, revealed anything like the increase in the changes deduced from arm-chair calculations. The conclusion tentatively suggested was that, partly but not wholly, the effects of differential fertility were being counterbalanced by the concurrent effects of certain genetic influences, easy to suggest but hard to prove.

This left the problem still undecided. Later investigations, like that of Dr Fraser Roberts at Bath, fully confirmed the negative correlation. And in 1932 a survey of all the children in Scotland born in 1921 was organized by the Scottish Council for Research in Education. No records were obtained at the time for the size of the various families. But in 1945 the Population Investigation Committee suggested a repetition of the survey, and undertook to secure the necessary financial aid. The suggestion was carried out in 1947; and the methods used and the data collected are fully described in the report now published.

The general arrangements were the same as before. An entire age-group, consisting of all the children in Scotland aged 11, was tested; and the same group test as that used in the 1932 survey was employed. So far from any decline being manifested, the average score turned out to be higher. The difference amounted to 2.3 points (somewhat more on an I.Q. scale), and was fully significant. The application of the individual tests to selected samples revealed a similar difference; but this might be explicable by a change in the Binet scale employed.

The main results have evidently come as a surprise to the investigators. They discuss various explanations that might account for the increase, and, on the whole, seem disposed to conclude that it is mainly due to increasing familiarity with intelligence tests of the type employed. So far, therefore, the main issue still remains unsolved. Further analyses of the data collected may conceivably lead to a more decisive conclusion. Meanwhile, the account of the planning, of the administrative organization, of the selection of tests, questionnaire items, and the like, will furnish much valuable assistance to those who may be contemplating similar surveys in the near future.

## 1587 Psychological Aspects of Clinical Medicine

Stephen Borton Holl. London: H. K. Lewis & Co. Ltd., 1949. xi + 416 pages. 22 x 14 cm. £1 1s. [£1.05]

(i) Introduction; (ii) investigation; (iii) intellectual development: psychometry and its application to medicine; (iv) emotional development and psychopathology; (v) common forms of psychoneurosis; (vi) psychological symptoms and physical disease; (vii) psychosomatic relationships; (viii) abnormal behaviour as a symptom of disease; (ix) relation of psychoneurosis to psychosis; (x) personality disorders; (xi) psychological aspects of management and treatment. Index of names. Index of subjects.

New books on psychiatry are plentiful, but many of them merely reflect the views of well-established works and are inferior to the originals. This book, however, is fairly new in concept and extremely ably written. The author has a sound grasp of his subject, and what he has to say is derived not merely from other books but from a wide clinical experience. His book covers those aspects of psychiatry which are likely to be of most concern to general practitioners and physicians; he develops his themes so steadily that his description of neurosis and psychosomatic relationships is reasonably easy to follow.

A minor criticism is that the chapter on psychopathology is somewhat condensed; the beginner would welcome more detail about mental mechanisms. Certain other criticisms on matters of detail could be made; for example, on page 59, dealing with the five grades of score on the progressive matrices tests, it is stated that grade 1 begins at the 95 percentile score; the other percentile scores given are also not those generally accepted. Grade 1 is usually placed at the 90 percentile score, grade 2 at the 70 percentile score, and so on. Again, on page 71 there is a numerical error. The sum of three weighted scores is multiplied by 5 and divided by 3, not multiplied by 5.3 as the text reads.

The conditions given on page 140 for the diagnosis of psychogenic illness compose an excellent summary which is well worth

teaching to students as it stands. The list of physical conditions frequently diagnosed as functional in nature is an interesting, but a personal, one. In the opinion of this reviewer, disseminated sclerosis is diagnosed as functional more frequently than the author suggests; and visceroptosis must be regarded with some suspicion as an organic diagnosis.

In the discussion of psychosomatic disorders an important fact, which is indeed frequently overlooked, is omitted. It is usually stressed and is now well recognized that certain disorders may be neurotically determined; but surely the author must have seen many psychosomatic disorders which were secondary to psychosis? Asthma often occurs in agitated depression, and pruritus ani and vulvae are also seen as depressive symptoms. In the discussion on delirium in relation to infective illness, the fact that there is usually a diurnal variation might have been emphasized; it might also have been pointed out that the infective element is often missed and is by no means necessarily obvious.

The chapter dealing with the relation of the psychoneuroses to psychosis is extremely good, and the discussion of the differential diagnosis is sound. There is no doubt that there is a difference between severe exogenous depression and melancholia. In extreme degrees these conditions are obviously different, and in the reviewer's opinion are different at the beginning even in their milder forms. The author rightly stresses that psychoanalytic treatment of an early psychosis may be disastrous. In this, as in all branches of medicine, correct diagnosis is essential before commencing treatment.

The criticisms of this book are, after all, minor; it can be heartily recommended to medical students and physicians, and psychiatrists will also find it worthy of their attention.

Robert Orton

## 1588 An Introduction to Physical Methods of Treatment in Psychiatry

William Sargant & Eliot Slater. With a chapter on treatment of the epilepsies, by Denis Hill. Second edition. Edinburgh: E. & S. Livingstone Ltd., 1948. xv + 215 pages. 22 x 14 cm. 10s. 6d. [£0.525]

(i) The insulin treatment of schizophrenia; (ii) modified insulin therapy; (iii) convulsion therapy; (iv) treatment of the epilepsies; (v) chemical sedation and stimulation; (vi) continuous sleep treatment; (vii) the use of drugs in psychotherapy; (viii) diet, vitamins and endocrines; (ix) prefrontal leucotomy; (x) the treatment of general paralysis; (xi) the relation of psychological to somatic treatment. Bibliography. Index.

The success of this comprehensive manual of psychiatric therapies, as shown by the appearance of this 2nd, revised edition, is first and foremost due to the full, lucid descriptions and explanations of the various more or less novel methods of physical treatments. They are taught by experts who speak from their own wide practical experience and the reader has the feeling that he makes contact, not with literature, but with the physician used to applying the treatment he describes. From the first sensational success of physical treatment in psychiatry 30 years ago—the malaria treatment of general paresis—all those therapeutic procedures which have stood the test of time and have become reliable adjuncts of psychiatric work in hospitals are dealt with: the various uses of insulin and hypoglycaemic treatment, convulsive therapy in its different modifications, chemical sedation, treatment by diet, vitamins and endocrines, and prefrontal leucotomy. In the new edition of this book the methods are brought up to date and new techniques, such as the abreaction methods using drugs, have been added and are fully discussed. Another important addition is the chapter on the treatment of epilepsy, written by Dr Denis Hill, who has incorporated recent progress on the theory of this illness as well as the practical application of electroencephalography into his clear and skilfully written discourse.

Beyond its practical usefulness, the present small book has the distinction of representing a new approach to psychiatry which has gained it many friends: the authors' restrained enthusiasm for active integration of psychiatry into clinical medicine and away from speculative and philosophical doctrines. In the introductory chapter as well as in the concluding part on the relation of psychological to somatic treatment this approach finds a concise and striking expression. These chapters, in fact, contain a psychiatric theory in a nutshell; this theory deserves elaboration and application on a much larger scale.

W. Mayer-Gross



### 1589 Psycho-Analysis. A Handbook for Medical Practitioners and Students of Comparative Psychology

Edward Glover. Second edition. London: Staples Press, 1949. 367 pages. 22 x 14 cm. 15s. [£0.75]

(i) Introductory. Section I. Theory of psycho-analysis. (ii) The embryology of mind; (iii) the dynamic aspects of mind; (iv) the structure of mind; (v) the economics of mind; (vi) phases of mental development; (vii) dreams and symptomatic acts; (viii) symptom formation. Section II. Clinical psycho-analysis. (ix) Introductory; (x) psycho-neuroses; (xi) psycho-somatic and allied disorders; (xii) psychoses; (xiii) transitional groups; (xiv) psychosexual disorders; (xv) social difficulties; (xvi) psycho-analysis of children. Section III. (xvii) Practical applications. Appendix. Glossary. List of books recommended. Index.

In his preface to this 2nd edition the author welcomes the opportunity of re-stating the basic theory of psychoanalysis but, in fact, the chapters on theoretical subjects occupy less than one-third of the book and are followed by a survey of the clinical field. There is much sound advice to general medical practitioners on the applicability of psychoanalytic methods of treatment. Finally, the book contains a useful glossary of psychoanalytic terms and a guide to the literature.

Glover claims that psychoanalysis is not merely a method of treatment, but that it has become an instrument of "diagnosis in depth" by applying the developmental approach to the classification of mental diseases. It has also been turned into an instrument of research and has produced a theory of mind—by utilizing three approaches to the full understanding of every mental event. In the topographic approach, Freud based his theory of mental structure on the concept of the reflex arc, with mind as the central system subdivided into a number of component parts, the mental institutions. The second, dynamic, approach deals with the excitations which disturb this central system, e.g., stimulations of unsatisfied instincts which produce either mental experiences (thoughts and feelings) or motor discharges which make up conduct and behaviour. Finally, mental activity may be regarded as an economic process, by which the psychic apparatus attempts to deal with instinct excitations which cannot be immediately discharged and which might produce discomforts, such as anxiety. The mind seeks to reduce stimulation and, on the other hand, deals with undischarged excitations by means of a number of mental mechanisms. Normality depends upon the degree of success which attends these manoeuvres, and this economic approach confirms that normality is an artificial concept and that "neuroses and other mental disorders are simply forms of unsatisfactory (inappropriate, unrealistic) discharges which occur when the individual has been unable to achieve a working balance between his instinct-tensions and the outlets permitted them either by himself or by his social environment". Psychological symptoms are regarded as "mental policies" to resolve conflicts between inner drives and wishes with outer reality; they may even be looked upon as "in part a spontaneous attempt at self-cure".

In addition to the further elaboration of these theories and their clinical application, the book contains numerous references to recent psychoanalytic work and concepts. Among these should be mentioned Glover's own contribution to ego development, in which he suggests that ego nuclei are laid down during the successive stages of development of instinct. These nuclei are looked upon as organized systems of memory traces and ideations contributing at first to the gratification and later to the control of specific instincts. The author admits the hypothetical nature of many central psychoanalytical tenets, especially those relying on interpretations of phenomena observed during the first 18 months of life, and yet at the same time he seems to accept as the only important inborn constitutional factor the individual's ability to tolerate frustration. The clinical part of the book contains a comprehensive account of the psychoanalytic contribution to the understanding and treatment of psychiatric disorders, ranging from the classical neuroses and psychoses, through the drug addictions, psychosomatic conditions and psychosexual disorders, to disabilities primarily of social rather than medical importance.

Very little space is given to a discussion of the methods of psychoanalytic research and of the way in which Freud and his pupils arrived at their theories, and it must, therefore, be assumed that this book is addressed to a reader who is already acquainted with psychoanalytic thinking; he will, however, find much to clarify his understanding of the theory and present-day trends of orthodox Freudian psychoanalysis.

Felix Post

### 1590 Psychobiology and Psychiatry. A Textbook of Normal and Abnormal Human Behavior

Wendell Muncie. Second edition. London: Henry Kimpton, 1948. 620 pages; 70 illustrations. 26 x 18 cm. £2 5s. [£2.25]

Part I. Psychobiology—the study of normal behavior. (i) Historical and philosophical bases of psychobiology; (ii) student's personality study; (iii) student's personality study (continued); (iv) student's personality study (continued). Part II. Abnormal behavior—pathology and psychiatry. (i) Historical account; (ii) examination methods and immediate findings; (iii) the static constitutional types; (iv) plastic psychodynamic minor reactions; (v) plastic psychodynamic minor reactions (continued); (vi) major reactions (holergasias); (vii) affective reactions; (viii) affective reactions (continued); (ix) topical delusional states and para-reactions; (x) para-reactions (continued); (xi) the support disorders (dysergasias); (xii) the acquired organic deficit reactions (anergasias); (xiii) the acquired organic deficit reactions (anergasias) (continued); (xiv) the convulsive state and allied conditions (the epilepsies). Part III. Treatment. (i) General bases of treatment and the procedure; (ii) important therapeutic aids; (iii) important therapeutic aids (continued); (iv) treatment of the static constitutional reactions; (v) treatment of the psychodynamic minor reactions; (vi) treatment of the major reactions (holergasias); (vii) para-reactions; (viii) dysergic reactions; (ix) organic deficit states; (x) treatment of convulsive disorders (the epilepsies); (xi) mental hygiene. Index.

The 1st edition of this American textbook for students appeared in 1939. The author is an Associate Professor of Psychiatry at Johns Hopkins University and he has worked with Adolf Meyer for almost 20 years. The book was welcomed as an authoritative account of the school of psychobiology, especially as the teaching of Meyer had been handed on mainly by word of mouth and no full and definitive version had previously been available, although the standard English textbook of Henderson & Gillespie was inspired by Meyer's views. Both in North America and in Britain these views have had an enormous influence on psychiatry, although they have received less attention on the continent of Europe where Meyer lived for the early part of his life. At a time when the opposing views of Kraepelin and Freud held the field, Meyer developed an eclectic approach which kept to the broad middle of the road. He regarded mental disorder as an "experiment of nature" and for him genetic-dynamic considerations took the place of hidden etiological factors; all the relevant exogenous, organogenic, neurogenic, psychogenic and constitutional elements in the individual were considered and evaluated. Unfortunately, in the exhaustive search for the patient's personality his disease tended to be overlooked. Thus the need for exactitude in diagnosis and prognosis was minimized, and treatment became similarly inexact and opportunistic. In diseases such as schizophrenia the followers of Meyer spent much time in tracing the development of the disease from a series of life-long maladaptations to various psychological and physical traumata, and they spent even more time in unrewarding efforts to treat schizophrenia by re-education. In the understanding and treatment of the superficial neuroses the Meyerian approach has borne more fruit.

These criticisms are criticisms of psychobiology; as an exposition of psychobiology, no adverse criticisms can be made of this book. In the first part, of 136 pages, the student is introduced to the study of personality in its longitudinal development and he is set useful exercises in self-appraisal. The second part, of 378 pages, describes the neuroses and psychoses, and numerous case-histories illustrate the psychobiological approach. The final part, of 94 pages, describes therapy. This 2nd edition has been brought up to date but is essentially unchanged from 1939. It gives a complete and readable picture of the work of Adolf Meyer, whose hitherto paramount influence on Anglo-American psychiatric thought is being lessened by the advance of other schools.

Hunter Gillies

### 1591 Conditioned Reflexes and Neuron Organization

Jerzy Konorski. Cambridge: University Press, 1948. xiv + 267 pages; 18 figures. 22 x 14 cm. 18s. [£0.9]

(i) Conditioned reflexes and the physiology of the central nervous system; (ii) an outline of Pavlov's theory of the activity of the cerebral cortex; (iii) a criticism of the Pavlov theory. Addendum: the Baritoff theory; (iv) general laws of the functioning of the nervous system; (v) excitability and plasticity in the nervous system; (vi) the conditioned reflex; (vii) alliances and antagonisms in the field of conditioned reflexes. (The summation of conditioned reflexes and external inhibition); (viii) the generalization of conditioned reflexes; (ix) internal inhibition. 1. Its nature and varieties; (x) internal inhibition. 2. The basic properties of inhibition. Addendum: on the phenomenon of sleep; (xi) the dynamic stereotype and hypnotic phases; (xii) conditioned reflexes of the second type; (xiii) nomenclature of the physiology of higher nervous activity; (xiv) conclusion. Index.

The acknowledged aim of this book is to build a bridge between Pavlov's massive, if somewhat insecure, theoretical edifice and the

more solid structure of Sherringtonian neurophysiology. This task is far from easy. As the author himself points out, the whole style of Pavlov's doctrine is foreign to traditional physiological thought. In particular, the neurone theory, with all that it implies for contemporary neurophysiology, finds no essential place in Pavlov's system. Although it might be possible, by special pleading, to reconcile some aspects of the latter with more orthodox conceptions of nervous activity, Dr Konorski has set himself the harder, but infinitely more rewarding, task of reinterpreting the whole of the data so painstakingly assembled by Pavlov and his school in the light of Sherringtonian principles. Even if he does not entirely succeed, no reader of this book can deny that he has tried extremely hard and, on the whole, extremely intelligently.

After a preliminary outline and critique of Pavlov's main theories, Dr Konorski undertakes a detailed examination of conditioned reflexes and their more important properties. The formation of a conditioned reflex he views in terms of the establishment of new synaptic connexions (presumably functional) between the cerebral "centres" involved. This is certainly an improvement on Pavlov's disconcertingly vague conception of the association process. In somewhat the same way, he regards internal inhibition as involving the formation of new and independent synaptic connexions of an inhibitory character. On this view, when a conditioned reflex is extinguished, a new inhibitory reflex is built up in such a way that, when the conditioned stimulus is applied, its cortical locus emits both excitatory and inhibitory impulses to the "centre" corresponding to the unconditioned stimulus. The magnitude of the resulting response will then depend on the relative density of the two hypothetical volleys of impulses. Although somewhat speculative, this is certainly a better idea than Pavlov's notion of an inhibitory process irradiating in some obscure manner from the central locus of the conditioned stimulus. Even so, it must be borne in mind that Konorski's hypothesis, although agreeing well with certain experimental data, at bottom does little more than postulate that, in the conditioning process, some change in cortical synaptic conduction patterns is involved. Its reception will presumably depend upon the extent to which it can stimulate fruitful experimental inquiry.

After a long theoretical discussion of various other conditioning phenomena, such as generalization and summation, the author passes on to some aspects of Pavlov's work relatively little known in this country. These do much to relate the fragmentary reactions studied by the classical conditioning technique to broader problems of behaviour. Thus it was shown by Pavlov himself that "... in conditioned reflex experiments each trial is not an independent event but forms a certain whole with other trials." This he termed the "dynamic stereotype". It is adduced to explain such facts as that when a system of conditioned stimuli is repeated daily for a long period in the same order of succession, a change in the sequence of the stimuli will produce comparatively little effect upon the response. If, for example, a strong stimulus is replaced by a weak one its effect will nevertheless be strong. Dr Konorski devotes some interesting discussion to "temporal patterning" of this kind which will do much to mollify those who have taken Pavlov to task for his apparent neglect of "gestalt" principles.

Dr Konorski's book is perhaps the first critical examination of the theory of the conditioned reflex to appear from one who was himself trained in the strict Pavlovian school. As might be expected, it testifies to a wide and intensive knowledge of the original literature. It is evident, too, that the author is first and foremost an experimentalist who was led to undertake this inquiry less from pure theoretical interest than from a wish to disentangle fact from dogma and so to free the road for fresh empirical research. Although Dr Konorski cannot rank as a theorist of the first order, his brave and scholarly book deserves close scrutiny. Despite its difficult and somewhat abstruse style, it will remain as a notable attempt to pierce the "iron curtain" of Soviet science and to relate what is most valuable in Pavlov's work to the general development of neurophysiology.

O. L. Zangwill

## 1592 Neurological Anatomy in Relation to Clinical Medicine

A. Brodal. Oxford: Clarendon Press; London: Geoffrey Cumberlege, 1948. xv + 496 pages; 94 figures. 25 x 16 cm. £2 2s. [£2.1]

(i) Introduction, methods, correlations; (ii) the peripheral motor neuron; (iii) the pyramidal tract; (iv) the extra-pyramidal system; (v) the cerebellum; (vi) the somatic afferent system; (vii) the cranial nerves; (viii) the optic system; (ix) the acoustic system; (x) the olfactory system; (xi) the autonomic nervous system; (xii) the cerebral cortex. Bibliography. Index.

This book, which first appeared in Norwegian in 1943, is an attempt to correlate the anatomy and physiology of the nervous system with clinical neurology. It was designed to be an up-to-date vade mecum for the clinical neurologist. It therefore omits most of the simple anatomy which one finds in the ordinary textbooks of neuro-anatomy and also omits most of the basic facts of neurophysiology. Such a book has the merit of placing the reader in contact with much recent work, both experimental and clinical, and saves the labour of hunting through the recent journals. The author successfully runs the risk of putting into italics any statements of fundamental value which are now verifiable postulates.

On the other hand, the very newness of the data tends to militate against the ordered historical perspective of the development of clinical neurology. Many of the new data are hot from the press, but they may not all stand the test of time. *Difficilis est sigillum veritatis*, particularly in neurology.

The introduction deals with the laboratory, experimental and clinical methods of the subject and then proceeds to deal in sequence with the lower motor neurone, the pyramidal tract, the extra-pyramidal system and the cerebellum. This is followed by chapters which deal in turn with the somatic afferent system, the cranial nerves, the optic system, the acoustic system and the olfactory system. The remaining two chapters deal with the autonomic system and the cerebral cortex. Thus the order of presentation, successful though it be, bears little relationship to the phylogenetic or ontogenetic development of the nervous system. The author is naturally at his best when dealing with his own well-known researches on the cerebellum. The section on the autonomic system is the most comprehensive in terms of space.

The reading of this book compelled the reviewer to re-read Romberg's *Lehrbuch der Nervenkrankheiten* (1840-46), Horsley's *Fullerian lectures for 1891* (1892) and Llewellys Barker's *The nervous system* (1900), and to conjecture whether in the near future we may have a book on clinical neurology based on the simple functional classification of Horsley. The latter maintained that the five kinds of function to be provided for were: (i) movement; (ii) sensation; (iii) tone; (iv) nerve supply to the blood vessels; (v) secretion.

The present volume by Brodal is timely and collects together much work of the last two decades. The illustrations are purposeful and concise. The English is clear. No clinical or laboratory library can afford to be without this book.

H. A. Harris

## 1593 Pathology of the Nervous System. A Student's Introduction

J. Henry Biggart. Second edition. Edinburgh: E. & S. Livingstone Ltd., 1949. xii + 352 pages; 232 figures; 10 coloured plates. 22 x 14 cm. £1 1s. [£1.05]

(i) The neurone and its reactions to disease; (ii) the reactions of the interstitial cells to disease; (iii) the cerebrospinal fluid in disease; (iv) vascular disease and the brain; (v) acute bacterial disease; (vi) chronic infections; (vii) diseases due to viruses; (viii) diseases of unknown etiology, possibly infective; (ix) intoxications and deficiency diseases; (x) degenerative diseases; (xi) injuries to the nervous system; (xii) tumours of the nervous system; (xiii) tumours of the nervous system (*continued*); (xiv) errors in development. Index.

As the quotation given by the author on the fly-leaf of this book says: "The study of things caused must precede the study of the causes of things!" Whilst recent knowledge of the latter is adequately summarized, emphasis is laid upon the morbid anatomy and histology of the common and important pathological conditions. The student, for whom the book is still intended as an introduction to neuropathology, gains much from the knowledge of general pathology possessed by Professor Biggart. A remarkable amount of information is contained within the covers of this excellent book, which, in spite of additional text and figures, is only 17 pages longer than the 1st edition. The use of coloured plates is very helpful, especially in the section on pituitary tumours. The new matter includes sarcoidosis, parasitic and fungal infections and polyarteritis nodosa. At the end of each chapter there is a short bibliography, which does not, unfortunately for the more

serious student, contain all the papers considered important enough to be mentioned in the text. It is not quite clear from the text that obstruction to large cerebral arteries causes ischaemic necrosis not only of the cortex but also of a wedge-shaped portion of underlying white matter. The presentation of the book is of the excellence one associates with Messrs Livingstone, but there

would be advantages in a larger page: illustrations and relevant text are more often visible together and there is less frequent turning of pages. In spite, however, of these criticisms it remains one of the best books on neuropathology, not only for students but also for their seniors.

W. Blockwood

## SOCIAL MEDICINE

### 1594 Mental Health Services. A Handbook on Lunacy and Mental Treatment and Mental Deficiency

F. B. Motthews. London: Shaw & Sons Ltd. [1949]. vi + 483 pages. 22 x 14 cm. £1 15s. [£1.75]

(i) Introduction; (ii) mental defectives and persons of unsound mind; (iii) the administrative structure—central and local; (iv) the powers and duties of the administrative bodies; (v) discharge of patients from detention. Appendix I: Lunacy, mental treatment and mental deficiency Acts, as amended. Appendix II: Lunacy, mental treatment and mental deficiency Orders, Rules and Regulations. Appendix III: Miscellaneous Acts and Orders, etc., dealing with mental patients or their income. Index.

This is a legal handbook dealing with the very complicated statutory law concerned with lunacy and mental deficiency in England and Wales. There is an excellent introduction, historical in character, and illuminating for those not familiar with the background of the development of legislation. Essentially a reference work, this book would appear to be by far the most comprehensive and accessible source of information now available, and is especially suitable for officers of mental hospitals, members of hospital boards, and medical officers of health. The illuminating notes, the attention to accurate detail, and the great care which has been given to devising a logical arrangement make the book unique; and the author manages, nevertheless, to call the reader's attention continuously to the main purposes for which the legislation was formed.

With the passing of the last remnants of the Poor Law and the disappearance of the officials who for so long had rather illogical statutory duties in "lunacy" and mental deficiency procedure, the time is particularly opportune for a re-statement of the law. No matter how drastic the change in social legislation in Britain and no matter how great the necessity appears for complete re-statement, a complete codification of the law in a single statute is never achieved nor, indeed, ever appears really seriously to be attempted.

Before the National Health Service Act of 1946, the major local authorities had become accustomed to administering the law regarding mental defectives and persons of unsound mind. Even if responsibilities were divided between departments, and if the provision of the old Poor Law sometimes entailed curious variations in practice, these local authorities dealt with all aspects of the problems of mental health. Now the public assistance committees and their officials who administered the Poor Law have gone, the mental institutions have passed to the Regional Hospital Boards, and there have been and still may be minor difficulties.

It seems to the reviewer that the intelligent use of this book should enable anyone in doubt to find the powers to take action and procedure for all the difficult situations which arise in practice.

Alon C. Stevenson

### 1595 Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death. Sixth Revision of the International Lists of Diseases and Causes of Death, Adopted 1948. Volume 1

World Health Organization. Geneva: World Health Organization, 1948. (Bulletin of the World Health Organization, Supplement 1.) xxxvii + 376 pages. 24 x 16 cm.

(i) Introduction; (ii) list of three-digit categories (detailed list); (iii) tabular list of inclusions and four-digit subcategories; (iv) medical certification and rules for classification; (v) special lists for tabulation; (vi) suggested form of multiple-cause tabulation; (vii) regulations.

This is the first volume of a two-volume statistical classification and index of diseases, injuries and causes of death. It follows the tradition established by the International List of Causes of Death and synthesizes the varied experiences of different countries in their use of the 1938 International List. Compiled by a group of recognized experts on health statistics, it represents the logical result of efforts dating from 1853 directed towards an internationally accepted classification upon which comparable statistics relating to causes of illness and death can be based. The classification is an improvement upon all previous lists in that it is designed for morbidity as well as mortality statistics, and, by its unanimous acceptance at the Sixth Decennial Revision Conference held in Paris in April 1948, wider international agreement than before has been achieved as to its use. The international agreement extends to details of tabulation and to standard groupings of diagnoses.

Volume I contains the classification itself and sets out the detailed categories and sub-categories of causes of illness and death, together with a supplementary classification of special admissions, live births, stillbirths, prophylactic inoculation, impairments, blindness and deafness. There is a section on medical certification and rules for classification, and other relevant material. There are 17 headings in the main classification which contain in detail some 612 categories of morbid conditions. The disease rubrics of the previous International List have been expanded to provide special categories for non-fatal diseases and injuries, whilst at the same time permitting comparability with certain categories of the preceding International List.

Volume II will provide a comprehensive alphabetical index to the classification in Volume I. At present it is a difficult matter to code some diseases and conditions. Several users of the *Manual*, however, are of opinion that when this index is available the classification will leave little to be desired, although further opinion based on its full practical application will be awaited with interest. The *Manual*, which must represent an enormous amount of work, contains several special aspects which warrant notice, particularly the section which covers accidents, poisons and violence, because here there is a departure from previous methods of classification and coding.

"The World Health Organization is offering this *Manual* in the hope and expectation that it will be, not merely an object of interest to medical statisticians, but the instrument for collecting information into a common pool of knowledge from which, in time, all mankind will benefit." This quotation from the preface to the volume makes the character and the aim of the classification clear.

L. E. Griffith

### 1596 The Design and Equipment of Hospitals

Ronald Ward. London: Baillière, Tindall & Cox, 1949. xvi + 360 pages; 177 figures; 50 plates. 25 x 19 cm. £2 2s. [£2.1]

(i) Introductory; (ii) general considerations; (iii) administrative considerations; (iv) medical considerations; (v) special wards; (vi) special hospitals; (vii) construction. Conclusion. Bibliography. Index.

This book, published at an appropriate moment following the inauguration of the National Health Service and in anticipation of

a revival of hospital building projects, provides a wealth of information of practical use to all who are interested in modern trends of hospital design and in the development of the hospital and public health services.

It is intended for doctors, hospital administrators, public health officials and architects. It provides guidance also for members of boards and committees in their consideration of building schemes and the policies involved. Though hardly to be classed as popular reading it will repay perusal by non-technical members of the public, and it should be welcomed particularly by students and by younger members of the architectural profession who intend to specialize in hospital design and who hitherto may have found the search for adequate and essential data on the subject to be somewhat arduous. The arrangement of the contents and the well-compiled index render the book useful for ready reference to any particular point.

The introductory section deals with general considerations of the hospital as it existed before the passing of the National Health Service Act, 1946, and with the formulation of hospital building schemes. The procedure relating to such schemes is described, and broadly meets the present position under the National Health Service Act; the main differences arise from the fact that the majority of hospitals are now vested in the Minister of Health and expenditure upon them is included in the annual estimates of the Ministry and is met by the Treasury, whose consent is necessary before expenditure is made on proposals costing over £10,000.

In the second section, the site and lay-out of the hospital, horizontal versus vertical planning, sizes of wards, orientation, interrelation of the various units and so on are dealt with. The advantages and disadvantages set forth provide useful material for discussion and final decision. The need for collaboration between the architect, the doctor, the administrator, and the heads of administrative, nursing and other departments is emphasized, with a view to ensuring that the hospital will meet fully the needs of the patients and will simplify the work of those engaged in their treatment and care.

The general hospital is comprehensively described and although some special hospitals, e.g., the mental hospital, receive less attention, the principles of planning are set out in such detail that their application, with such modification as is necessary to meet special needs, should not entail any great difficulty to those concerned. The frequent references in various sections to planning simple and beautiful buildings, of architectural interest externally and internally, in pleasant surroundings, and with colour schemes which have soothing effects upon the patients, are summarized in the conclusion.

The book is illustrated with diagrammatic plans and photographs of interiors, and provides a general survey of the present trends in design. It is worthy of study by all who have at heart the welfare of the sick. Sufficient mention is made of standardization to show the dangers of stereotyped planning which can hinder progress; though some standardization of fittings and equipment may effect saving in cost, the need for continual research and experiment in planning and equipment, to effect still greater advances and improvement, is imperative. Readers may disagree with many of the views expressed; this is not undesirable, however, as it may lead to discussion of these views and to further efforts to improve upon them in an endeavour to attain the ever-elusive perfection.

F. C. W.

**1597 Hadden's Health and Welfare Services Handbook. Being a General Guide to the Law Relating to the Health and Welfare Services Administered by Local Authorities, Together with National Insurance and National Assistance**

John Moss. London: Hadden, Best & Co. Ltd., 1948. xxi + 376 pages. 19 x 12 cm. £1 5s. [£1.25]

(i) Central and local authorities; (ii) National Insurance and National Assistance; (iii) National Assistance Act, 1948 (extract from Ministry of Health Circular 87/38, June 7, 1948). Appendix B: National Assistance Act, 1948 (Second Schedule). Index.

The passage of the National Health Service Act, 1946, the National Assistance Act, 1948, and, to a lesser degree, the Children Act, 1948, has laid upon local authorities new and complex duties. Mr Moss's handbook sets out these duties in a simple and easy form, and, at the same time, shows how important it is for anyone who wishes fully to grasp the potentialities and significance of these Acts to have some understanding of the various schemes of national insurance provided by the National Insurance Act, 1946, and the National Insurance (Industrial Injuries) Act, 1946. The book reviewed here provides a short, but clear and admirable, guide to all this complicated legislation; the appearance of Mr Moss's name upon the title-page is the best guarantee of its excellence.

One of the results of the break-up of the Poor Law has been the development of a too rigid separation between those who need residential accommodation because they are sick, e.g., in hospital under the Regional Hospital Boards, or Boards of Governors, and those who need it because they are destitute, using the word in its broadest sense, e.g., in accommodation provided under Part III of the National Assistance Act, where local authorities are required to make provision for persons who "... by reason of age, infirmity or other circumstances are in need of care and attention". Under the Poor Law the Relieving Officer could arrange accommodation for all who needed it. This accommodation was often not ideal, but at least a roof, bed, food and nursing were available. Now there is emerging a type of person whom the Regional Hospital Board or Board of Governors will not accept because they are not really ill, yet who are too infirm to be accommodated in an institution or hostel for the healthy. Ultimately they will be dealt with under Part III of the National Assistance Act, but even when the provisions of the local authority services are available to the full, it will be necessary to have the closest co-operation between the Regional Hospital Boards and Boards of Governors and the local authority so that a patient who is being accommodated under the provisions of Part III can be easily transferred to a hospital, and a hospital patient who is not in need of full medical and nursing care similarly transferred to accommodation under Part III. Mr Moss rightly emphasizes the importance of this "two-way" traffic, which is, indeed, the only way to ensure the continuance of an excellent principle that was inherent in the Poor Law, whereby patients could move easily from workhouse to hospital as their condition required. Failure to secure this co-operation would lead to the development of a new type of infirmary where the chronic, or long-term sick, would lie for years with little or no medical attention.

There is also a danger that the substitution of 300 area offices of the National Assistance Board for some 1,500 Relief Districts will make it more difficult for the old and the destitute, if "relief" is to be used in its fullest sense, meaning that it can be obtained in an emergency, when it is needed most. The Relieving Officer resided in his district, and being personally responsible for what went on in that district, knew the people most likely to be in need of relief, and maintained what was, to all intents and purposes, a 24-hour service. As Mr Moss points out, such a service cannot be restricted to ordinary office hours, but the 24-hour service will be more difficult to maintain when it is administered from a number of central offices.

The other important change that is discussed in this book is the new situation that has arisen with the passing of the Children Act, 1948. Under this, a special officer, the Children's Officer, is appointed to look after the welfare and interest of those children who have been deprived, for one reason or another, of normal home life and parental care. The admirable intention of this Act was to bring up these children, living in accommodation provided by the local authority, in as normal and happy a way as possible. The health and education departments of a county or county borough council deal with normal children at varying stages of their life, and it might have been wiser if the Children's Officer had been a member of the staff of one or other of these departments, preferably of the former, and thus to have assured that these unfortunates, with all other children, would have been the responsibility of the same department of the council. This would have assisted in enabling them to live as normal a life as possible and to grow into normal adults.

Mr Moss's book is clearly written and well indexed, with a wealth of reference to the Statutes and to the many Regulations and Orders made under them. Certainly no local authority can afford to be without this book, and anyone working in the field of welfare today will find it a valuable possession.

Amulree



### 1598 Taylor's Principles and Practice of Medical Jurisprudence. Volume II

Originally written by Alfred Swaine Taylor. Tenth edition edited by Sydney Smith, with a complete revision of the legal aspect by W. G. H. Cook and of the chemical aspect by C. P. Stewart. London: J. & A. Churchill Ltd., 1948. vii + 841 pages; 7 illustrations. 25 × 16 cm. £2 10s. [£2.5]

Part I. Sexual medical jurisprudence, obstetric and criminal. (i) Impotence and sterility; (ii) virginity and defloration; (iii) pregnancy; (iv) delivery; (v) dissolution and nullity of marriage; (vi) legitimacy and paternity; (vii) rape; (viii) abortion; (ix) natural birth and medico-legal questions connected therewith; (x) infanticide; (xi) unnatural offences. Part II. Poisoning and toxicology. (xii) The law of poisons, including the definition of a poison or noxious thing; (xiii) dangerous drugs; (xiv) the action of poisons and the circumstances which influence it; (xv) diagnosis of poisoning; (xvi) what to do in cases of poisoning; (xvii) classification of poisons. A chapter on medical jurisprudence in India. Appendix: the rhesus factor. Index.

The 10th edition of this work,<sup>1</sup> although retaining the principal features of "Taylor," has been thoroughly revised and brought up to date. In some parts, the arrangement of the book has been slightly altered, and certain sections have been completely rewritten; a considerable quantity of fresh material has been added.

For review of Vol. I see *BMB* 1355 (*Brit. med. Bull.* 1949, 6, 99).—Ed.

Volume II of the work, which is considered here, is divided into Part I, which treats the wide subject of sexual medical jurisprudence, and Part II, which covers the field of toxicology. The sexual subjects include impotence and sterility, nullity of marriage, pregnancy, rape, abortion, infanticide, and unnatural offences. Each of these sections includes appropriate decisions of English Courts of Law.

The section on toxicology deals with the law controlling the sale of poisons, including a description of the various poisons and their actions; it also describes the diagnosis and treatment of poisoning and the post-mortem findings in fatal cases. It is unfortunate that the list of drugs composing the Fourth Schedule of the Pharmacy and Poisons Act, 1933, and the list of dangerous drugs as set out in the Dangerous Drugs Act, 1932, have not been brought up to date, and that the omissions from these lists should include such drugs as tridione and pethidine, respectively. The accounts of the mode of action and symptomatology of the various poisons are very well represented and are most informative. It seems odd that, in a book of this size, there should be a complete absence of photographic plates.

Those responsible for the revision and editing of this second volume have to be congratulated on their success in completing such a difficult task.

John Glaister

## MEDICAL SCIENCES & RESEARCH

### 1599 The Mammalian Adrenal Gland

Geoffrey H. Bourne. Oxford: Clarendon Press, 1949. vi + 239 pages; 226 figures; 15 plates. 24 × 16 cm. £1 10s. [£1.5]

(i) Historical; (ii) vertebrate adrenals and classification of mammals; (iii) the adrenals of the monotremata; (iv) the adrenals of the metatheria; (v) the adrenals of the eutheria; (vi) general summary of mammalian adrenals. Bibliography. Index. Plates.

If, as far as endocrinology is concerned, the twenties of this century were the decade of insulin and thyroxine, the thirties the decade of the sex hormones, the forties the decade of the anterior pituitary, then all the signs indicate that the fifties are likely to be the decade of the adrenal cortex. Though Addison's famous clinical study of adrenal deficiency provided one of the opening chapters of the long story of endocrinology, the complex pattern of the participation of the adrenal cortex in a variety of physiological functions is only now being unravelled. Intensive work on the chemistry and physiological function of the numerous steroids secreted by, or at least obtainable from, the adrenal cortex, hitherto rather a close preserve of the specialist, and presenting by its very complexities a somewhat forbidding aspect to the general biologist, has recently been illumined by the spectacular discovery of incalculable therapeutic possibilities for the application of one of the cortical steroids as a palliative for one of the most intractable and crippling diseases which afflict mankind, rheumatoid arthritis. This discovery seems likely to appeal to the public imagination in the same way as did the discovery of insulin, and there is no doubt that scientific attention is likely to be focused on the adrenal gland for a long time to come. This being so, the recent appearance of one or two books dealing with this endocrine gland, of which Dr Bourne's is one, can be considered timely.

At the outset it should be said that the title of Dr Bourne's monograph is not as informative as it might well have been. An abbreviated title of such general implication might lead the reader to expect a treatise dealing not only with the anatomy but also with the physiology, pharmacology and metabolic functions of the adrenal and especially of the cortex. In fact, as the author explains in his preface, it is based largely on material submitted many years ago for the degree of D.Sc., and this, the main theme of the book, comprises a comparative study of the anatomy of the adrenal gland in a wide variety of mammalian forms. A monograph of this type is usually caviare to biologists in general, since by its very nature it is addressed to specialists, for whom it constitutes a valuable source of reference. For this reason such monographs are often not easy to get published, and when they are published the price is

apt to be high. Happily this is not the case with the book under review.

The first chapter is historical and opens, in the reviewer's opinion mistakenly, with a passage in Latin of which no translation is provided. Another Latin quotation follows hard on the heels of the first. This is apt to be irritating to readers educated by those who do not consider an ability to read obsolete Mediterranean languages as necessarily an essential ingredient of a good education. Other descriptive chapters follow in which the anatomy of the adrenal gland in various mammalian species is considered, often rather catalogue-wise. At times one may detect a certain emphasis on Australian mammals, which perhaps reflects the author's own interests. Many of the descriptions are given here for the first time by the author and descriptions given by others are discussed where appropriate. One feels that in some cases the description is based on too few specimens to carry full conviction while often, as the author is careful to point out, the material is far from ideal for histological study, having been taken from museum specimens after many years in preservative. Nevertheless we have here a conspectus of much out-of-the-way descriptive data which may well be of interest to other specialists in this field.

The material of more general and immediate interest to the endocrinologist is confined to a final chapter entitled "General summary of mammalian adrenals." This chapter, besides embodying a general summary, one might say an attempted synthesis, of what has gone before, includes brief surveys of the physiology of cortex and medulla. The general nature of the book's title, already referred to, might well have led the reader to expect more extensive treatment of what is at the present time very much a live experimental subject, as attested by the number of symposia and reviews on adrenal cortex endocrinology which have appeared in recent years. Effective use could have been made of these in expanding this part of the book without necessarily swamping the anatomical section, with an enhancement of the value of the book and a widening of its appeal. This final chapter also includes an excursion along the perilous path of attempting to deduce evolutionary relationships (with particular reference to marsupials) from the anatomical position of the adrenal glands. Such speculations are always interesting, seem a peculiarly fruitful cause of lively, even heated, controversy, and are justified provided the conclusions are not too finely drawn.

As is to be expected from this publisher, the volume is a good piece of book-making. Unfortunately lack of care in proof reading is evidenced by too frequent occurrence of errors in spelling. Authors' initials are omitted from the bibliography, which is a pity,



S. J. Folley

Edited by *Frank L. Horsfall*. New York : Columbia University Press ; London : Geoffrey Cumberlege, 1949. x + 153 pages ; illustrations. 23 x 15 cm. £1 1s. [**£1.05**]

epidemic, murine, and scrub typhus, as well as Q fever; (xii) the diagnosis of Rocky Mountain spotted fever and rickettsialpox; (xiii) the diagnosis of infectious hepatitis.

One of the most useful chapters is that on primary atypical pneumonia, where the unsatisfactory position with regard to this broad group of infectious diseases is clearly set out by Horsfall, who edited the volume.

There is a striking omission of any instruction on the collection of material for the diagnosis of smallpox, although the symposium took place after a series of cases in New York in 1947. The diagnosis and control of the pox group of diseases is one of the main public health problems over a considerable part of the globe. On the other hand, there is a chapter on infectious hepatitis, although no specific *in vitro* test or susceptible experimental animal has been found for this presumed virus infection.

Most chapters follow the same general pattern. First, there is a brief general note and frequently some remarks on the epidemiology of the disease. A description of the type of specimens required is given, also the time at which they should be collected for virus isolation, and the methods used in the laboratory. This is followed by instructions for the collection of sera for antibody estimations, the tests used and the interpretation of the results.

Investigation of virus disease in the laboratory is still somewhat specialized work, but this book should be of considerable value to the pathologist who wishes to start work in this field himself, and, what is more important to all concerned, it should aid the physician to obtain the correct material at the correct time for suitable investigation.

The material is clearly laid out and there are numerous useful tables and graphs. Each chapter contains an adequate bibliography up to 1947 or 1948. It is unfortunate that this book, and others of its kind, should be so expensive.

*F. O. MacCallum*

David Thomson & Robert Thomson, assisted by James Todd Morrison. Edinburgh: E. & S. Livingstone Ltd., published for the Pickett-Thomson Research Laboratory, 1948. xi + 329 pages. 28 x 22 cm. £2 2s. [£2.1]

Part I. Oral immunization, general information. (i) Introductory; (ii) historical; (iii) histology of the digestive tract and the mechanism of absorption; (iv) the phenomenon of enterotropism; (v) the protective defences of the digestive tract against the oral invasion of living bacteria; (vi) experimental evidence regarding the permeability of the intestinal mucosa to living bacteria; (vii) methods of increasing the permeability of the intestinal mucosa to bacteria and bacterial toxins; (viii) are bacterial vaccines and toxins given by the mouth altered by the gastro-intestinal secretions as to become useless for immunization purposes? (ix) theories on the mechanism of the immunity induced by oral vaccines. Part II. Oral method of prophylactic immunization against various diseases. (x) Typhoid fever; (xi) bacillary dysentery; (xii) cholera; (xiii) plague; (xiv) tuberculosis; (xv) diphtheria; (xvi) Malta fever; (xvii) oral cocci; (xviii) oral immunization against colds and coccocal vaccines; (xx) oral gonococcal vaccines; (i) oral streptococcal vaccines; (xixii) oral vaccines; (xxiv) autogenous oral faecal vaccines in treatment of intestinal infections; (xxv) *Bacillus pyocyaneus* vaccines given per rectum; (xxvi) oral vaccines against animal diseases; (xxvii) oral prophylactic immunization against smallpox; (xxviii) oral immunization against measles with placental extracts; (xxix) passive immunization by serums administered by mouth; (xxx) oral pus vaccines in treatment of wound infections; (xxxi) oral immunization in hay fever and ragweed pollinosis; (xxxii) oral immunization against poison ivy dermatitis. Part III. Oral prophylaxis with toxins and toxin-antitoxin mixtures. (xxxiii) Scarlet fever; (xxxiv) diphtheria (prophylactic immunization against diphtheria with toxin-antitoxin mixtures by the mouth); (xxxv) staphylococcus toxin; (xxxvi) oral tetanus toxin, etc.; (xxxvii) animal experiments with *Clostridium botulinum* toxin; (xxxviii) treatment of diphtheria antitoxin. Part IV. Immunization by oral vaccines. (i) regional vaccination at the portal of entry; (xlii) treatment of wound infections by submucous injections rough the skin by means of cutaneous intunction; (xliii) tuberculosis treated with tuberculin; (xliv) animal experiments with tuberculin. References to literature. Index of subjects.

As the authors state in the preface, "This book is an attempt to bring together into one volume the results of many researches on oral vaccines and attempts at immunization by other non-parenteral routes." They have succeeded in compiling a well-documented work of reference which will be of considerable value to those interested in the research aspects of immunization by non-parenteral routes and in their practical application in preventive medicine.

It is agreed that gastric acidity plays an important part as a bactericidal line of defence against orally ingested living bacteria. There is also no doubt about the permeability or penetrability of the intestinal mucosa by certain living organisms—tubercle bacillus, typhoid and paratyphoid bacilli, and *Salmonella* and *Brucella* organisms—but how much of this is due to damage to the intestinal mucosa caused by the organisms themselves, or to entry via minor abrasions of the mucosa, is not proven.

It is claimed that bacteria are constantly invading the intestinal mucosa. In dysentery, however, where infection is usually confined to the mucous membrane of the gut but accompanied by ulceration, serum antibody production is very weak; moreover, there is little or no evidence of concurrent antibody formation vis-à-vis the normal flora which might be expected to pass the damaged mucosa.

One-third of the volume is devoted to oral immunization against tuberculosis, especially with living BCG vaccine. The majority of investigators agree that oral BCG does produce immunity, but only after a long interval, and the percentage of positive tuberculin reactors following immunization is not as high as expected. Despite the pioneer work of Calmette and many others, there is now a definite swing from the oral route to the intracutaneous method of administration of BCG.

Prophylactic immunization against typhoid fever by oral vaccines provides the most conclusive evidence of immunity induced by this route. On balance the degree of immunization produced appears at best to be as good as, but in general of a lower order than, that produced by immunization by the usual parenteral routes. There is much less certainty that a satisfactory level of immunity will be produced by the oral route.

Oral vaccines of dysentery (Shiga and Flexner), cholera, and plague organisms have given either inconclusive or disappointing results. Vaccines of dysentery organisms appear to produce a local cellular immunity with little evidence of humoral immunity. No evidence of value in human immunization is adduced for oral vaccines prepared from staphylococci, gonococci, streptococci, *Salmonellae* or *B. coli*.

A section is devoted to oral immunization against colds and influenza, but these are virus infections, and oral vaccines made from pathogenic and suspected pathogenic respiratory organisms could not be expected to induce immunity, except possibly to secondary invaders. Claims to prevent colds and influenza by the use of bacterial vaccines given orally (or parenterally) must be

viewed very critically and the evidence brought forward provides little support for their value.

Reference is made to investigations as to the value of vaccines administered by inhalation, intratracheally, intranasally, spraying into the nose and throat, incorporated in toothpastes, in ointments for skin inunction, and via the rectum and conjunctiva. There does not appear to be much future for these routes except perhaps by skin inunction, and the immunity produced is slow to develop and not so potent as that produced by injection methods.

In fine, oral vaccines appear to be subject to wide variation in the absorptive powers of the intestinal mucosa in different individuals; much larger doses are required—40 to 100 times greater than those given by the usual parenteral routes; antibodies are slow to develop, and the level of immunity produced does not appear in general to be as high as that introduced by immunization by skin injection methods. On the credit side, there is the ease of administration, repeated as often as may be desired, and the almost total absence of reactions.

V. D. Allison

## 1602 The Filterable Viruses

Francis O. Holmes. London: Baillière, Tindall & Cox, 1948. (Supplement No. 2, Bergey's Manual of Determinative Bacteriology, Edition VI, 1948.) 160 + xxiii pages. 23 × 15 cm. £1

The classification of bacteria has long been a matter for disagreement. Undoubtedly we shall eventually attain the ideal of a comprehensive classification using the binominal system of nomenclature but it is impossible simply to adopt the rules which have been found applicable to the taxonomy of animals and plants. Ambitious schemes have been suggested, notably by Bergey and his collaborators, and their system is expounded in the well-known *Manual of determinative bacteriology*. However, their classification has not received any general assent because many feel that the criteria used to define species are too unstable to be of a taxonomic significance and that the time is not yet ripe for any detailed system because of the peculiar way in which bacteriology has been studied, i.e., mainly as an applied medical science. The study of viruses is even more in its infancy, and to attempt any classification at this stage is a most hazardous undertaking. This supplement to Bergey's *Manual*, however, represents such an attempt.

While the reviewer is not competent to criticize the treatment of the plant viruses, he must state his opinion that the classification of the animal viruses and of the bacteriophages is far from satisfactory. The suggested classification of the bacteriophages is useless for all practical purposes and adopts an extremely limited view of even our present knowledge of these ubiquitous viruses. The classification of the animal viruses is somewhat of a travesty. It is possible to mention here only a few examples to illustrate the curiosities which abound.

There is no agreement that the common-cold virus has ever been isolated, yet it is here classified as *Tarpeia premens* (from *Tarpeia*, name of a Roman maiden who treacherously opened a citadel to an enemy). In contrast, there are many well-recognized viruses, such as Horsfall's mouse pneumonia virus, which are not mentioned at all. There is no recognition of the fact that the ectromelia virus is closely related to the pox group. The mumps virus is classified for no good reason with the animal salivary gland viruses, but its relationship to the viruses which cause haemagglutination is disregarded. The urgent practical problem of discovering the relationships between the poliomyelitis viruses, Theiler's O virus, the S.F. groups, and the M.M. group, is not considered.

The new names proposed have nothing to recommend them except their unfamiliarity and their elusive classical connotations. In bacteriology it has happened that elaborate systems of classification of certain groups of which we have special knowledge, such as the Salmonellae, have received wide agreement. In the same way tentative schemes for the classification of the influenza viruses have begun to appear. And it is better that taxonomy should proceed for a time in this piece-meal fashion.

It is to be earnestly hoped that at the next International Microbiological Congress the present proposal will be repudiated and that the attempt to classify viruses will be postponed until more is known of this subject.

Forrest Fulton

## 1603 Haemoglobin: A Symposium Based on a Conference Held at Cambridge in June 1948 in Memory of Sir Joseph Barcroft

Edited by F. J. W. Raughton & J. C. Kendrew. London: Butterworth's Scientific Publications, 1949. xii + 317 pages; illustrations. 25 × 16 cm. £2

(i) Tributes to Sir Joseph Barcroft; (ii) reversible reactions with oxygen and carbon monoxide; (iii) analysis and amino acid composition; (iv) X-ray crystallography; (v) physico-chemical properties; (vi) biochemical and physiological aspects; (vii) differences between adult and foetal haemoglobin; (viii) comparative biochemistry and physiology of oxygen carriers. Author index.

This is a memorial volume to Sir Joseph Barcroft, who died in March 1947. It contains contributions of those who were invited from all parts of the world to attend a symposium on haemoglobin. The symposium was held in Cambridge in June 1948 in commemoration of Barcroft, to whose classical work is owed so much of the knowledge of the respiratory function of blood. The symposium was also held to carry on the annual meetings to discuss problems related to haemoglobin that Barcroft inaugurated in Cambridge after the war.

The book illustrates how biological science makes use of every available tool of the physical sciences. Thus there are contributions from physical chemistry, organic chemistry, spectroscopy, crystallography and mathematical physics; this makes the book of great interest to chemists, as well as to physiologists and biochemists.

The first of the book's eight sections contains tributes by eight physiologists who knew and worked with Barcroft. They give a vivid and delightful insight into his personality and greatness, each revealing a different facet of his quality. Each of the sections following contains original papers by different authors, giving their context, and can thus be appraised by anyone unfamiliar with the field. The work described is outstanding; the papers are stimulating and readable. The majority deal with experimental work, but some are entirely given to theoretical discussion. For example, Wyman discusses the relation of the kinetic data of the reactions of haemoglobin to the shape of the molecule (for a fuller account see *Advances in Protein Chemistry*, vol. 4), and Pauling discusses its electronic structure in relation to its properties.

The papers are not well arranged, however, and this gives a disjointed impression. It would have been more logical to place Raughton's gasometric determinations of oxygen dissociation curves, and their relation to the intermediate-compound hypothesis, before Drabkin's latest elegant spectrophotometric measurements *in vivo*. The latter do not coincide with gasometric measurements, the validity of which when applied to the living animal is questioned. The arrangement of the crystallographic section can also be criticized. Here a simplified explanation of mathematical methods used in crystallography appears at the end. Anyone but a crystallographer would find it helpful to read this before the other papers, which include brilliant analyses of horse haemoglobin and myoglobin, in which the shapes of the molecules are deduced in remarkable detail.

Lack of space prevents even a cursory indication of the most interesting papers, which include an account of a new method of determining "end-groups" in proteins. Apart from a small section on cytochrome C, the book is concerned only with haemoproteins functioning as oxygen carriers, and furthermore embraces an interesting comparison of the oxygenation efficiency of haemoglobin and haemocyanin, whose prosthetic group is not a porphyrin. Most of the work described was unpublished at the time of the conference, and so the book is up to date.

H. M. Muir

## 1604 Cardiovascular Studies

Kenneth J. Franklin. Oxford: Blackwell Scientific Publications, 1948. xvi + 306 pages; 102 figures. 25 × 19 cm. £2 2s. [£2.1]

Part I. Historical note on the Eustachian valve and the intervenous tubercle of Lower. Part II. (i) Terminology; (ii) techniques, and the evolution of a concept; (iii) note-taking; (iv) some general references to the literature, and an introduction to personal observations; (v) *Homo sapiens*. References to the literature, personal observations, and Table I. Part III. References to the literature, and personal observations on other mammals. (i) Primates; (ii) Menotyphla; (iii) Lipotyphla; (iv) Chrysochloridae; (v) Dermoptera; (vi) Chiroptera; (vii) Carnivora (Carnivora vera, or Fissipedia); (viii) Pinnipedia; (ix) Cetacea; (x) Rodentia (or Rodentia simplicidentata); (xi) Lagomorpha (or Rodentia duplicidentata); (xii) Proboscidea; (xiii) Hyracoidea; (xiv) Perissodactyla;

G. Weddell

W. F. F. & M. P. S.

## J. N. Davidson

## M. E. Morgans

This book must be unique in having contributions, representing attacks on a common fundamental problem, from physicists, physiologists, anatomists, histologists, photochemists, and psychologists. Neuro-anatomy, the quantum theory and non-Euclidean

geometry are all involved. It is difficult therefore for the reviewer to do justice to the variety of material; to be equally happy with the descriptive anatomy of the micro-structure of the retina, the terminology used in colour psychology and with the mathematics of highly contorted surfaces. If, however, he cannot express an expert opinion on each and all of the papers, he can at least be thankful that the bad old days of acrimonious debate between protagonists of different colour vision theories conceived from physical, psychological, comparative anatomical, physiological or evolutionary standpoints, have given way to a state of affairs where the bulk of the interested parties from a large part of the world can gather together and genuinely begin to understand each other's language and approach. Let us hope that this will be the first of many similar conferences.

It is a pity, in view of the particular nature of the compilation, that the discussions are not more fully reported. One gets a few accounts of the cross-questioning of, for example, a physiologist by a physicist; but more might have been included. There are some glaring examples of faulty logic (dare I say, more particularly on the part of biologists?). Polyak in his paper on the structure of the retina concludes (p. 31) that because the central foveal cones are morphologically fairly uniform, they must all be alike in photochemical properties. Again, he concludes (p. 43) that because there is colour vision in the central fovea, an area he declares to be rod-free, "... this rules out the rods from the rank of mechanisms instrumental in colour vision in the strict sense." Hartridge and Granit, both physiologists, appear to have come in for the heaviest fire of criticism. It is difficult to avoid the impression that the former, in spite of a fine collection of references, has not understood them all, or at least is not accurately representing the arguments of others, while the latter offsets brilliant experimental ability with a lack of critical appraisal in presenting his results and conclusions.

Altogether this is a most stimulating book, of no narrow interest, not only to researchers on colour vision, but to neurologists, experimental psychologists, biophysicists and many others. It is handsomely produced and typographical errors are few. To have included an index would have been rather a luxury. If there is any complaint about the production it is that a better type face might have been chosen for a book on vision. One is surprised also to find no mention of the contents of the preceding volumes, I and II in the *Advances in Ophthalmology* series.

H. V. W.

## 1609 Visual Development. Vol. 1

J. H. Prince. Edinburgh: E. & S. Livingstone Ltd., 1949. xii + 418 pages; 190 figures. 22 x 14 cm. £2 10s. [£2.5]

Part I. (i) Photoreception; (ii) perception; (iii) retinal structure in man; (iv) retinal structure in animals; (v) photochemical aspects; (vi) retinal stimulation quanta. Part II. (vii) Evolution (invertebrate); (viii) evolution (vertebrate); (ix) the evolution of nocturnality and the return to diurnality; (x) pupillary function; (xi) increased sensitivity of the retinal bacillary layer; (xii) tapeta; (xiii) sightless vertebrates and luminous organs. Part III. (xiv) Colour appreciation in the lower orders; (xv) evolution of colour vision; (xvi) colour vision in man. Part IV. (xvii) Night-vision and dark-adaptation in man; (xviii) night-vision and dark-adaptation tests; (xix) the association of nystagmus with retinal defects. Part V. (xx) Routine examination of the eyes of animals; (xxi) examination of sections through the microscope; (xxii) fundus significance. Glossary. Bibliography. Index.

As we look into the outside world, we are conscious of the shapes and sizes of external objects; we perceive their colour, their solidity and their form; we can estimate their distance from us; we can discern their movement, or we can observe our own movement with respect to these objects; moreover, we can perform many of these feats over a very wide range of illumination, and we can carry away mental pictures of all that we have seen.

When we study our own eyes, we can to some extent correlate structure with function; and when we study the eyes of animals we see other patterns and other arrangements correlated with the same and other functions. By comparative methods a fuller understanding is obtained, and in no subject is this more true than in vision, for the field of vision has indeed many sides. Important contributions to the growth of knowledge in that field have come, and must come again, from physicists, physiologists, psychologists, physical chemists, zoologists and naturalists.

When the breadth of the subject is thus considered, it is clear that the author of *Visual development* has set himself a large task and has thus of necessity laid himself open to much criticism, since it is hardly possible to be equally expert in all branches. Never-

theless, in this first volume, he brings together much important information and compels the student of vision to think beyond the range of purely human sight. It is with the help of contributions of this type that the human eye can be seen in its true relationship as a single point in the evolutionary development of the eye in general, with some advantages over other eyes and with some disadvantages.

The book is divided into five parts. In Part I, the general functions of the eye are discussed and the salient features of retinal structure and cerebral representation in man and animals are described. This part, like so many earlier discussions of the subject, suffers from some confusion of thought, much of which arises out of the definition or lack of definition of the terms "rod" and "cone". Moreover the illustrations in this part of the book do not assist as much as they might.

Part II is devoted first to the evolution of eyes in both invertebrates and vertebrates, and this is followed by a discussion of eyes in relation to diurnal and nocturnal activity, with particular reference to such things as pupil shape, retinal structure and the formation of tapeta. In much of this section attention has been diverted to aspects of evolution other than those concerned directly with vision. Sometimes this is helpful, but often it borders on the irrelevant. Nevertheless it is clearly an important approach to a proper understanding of vision to relate the evolution of the optical structure to the evolution of the animal's structure and behaviour as a whole.

Part III discusses the significance of colours and colour vision, and gives an account of the occurrence and possible significance of colour vision in different groups. Some of the chief theories of human colour vision are also discussed. In Part IV, an account of dark-adaptation and its measurement, and of the relationship of nystagmus with night vision, is given. Part V jumps surprisingly from a description of how to hold live snakes to a practical guide to the preparation of eyes for routine histological examination, and thence to a descriptive account of the structure of the fundus of a wide variety of eyes.

The volume as a whole contains much interesting, and often unusual and important, information, but it is somewhat uncritical in outlook and devotes, at times, far too much space to matters which seem beyond its proper domain.

E. N. Willmer

## 1610 Pathology

Edited by W. A. D. Anderson. London: Henry Kimpton, 1948. xii + 1453 pages; 1183 illustrations; 10 colour plates. 25 x 17 cm. £3 15s. [£3.75]

(i) Introduction; (ii) cells and their behavior; (iii) inflammation; (iv) degenerative changes and disturbances of metabolism; (v) disturbances of circulation; (vi) physical agents in the causation of injury and disease; (vii) chemical injury; (viii) effects of radiation; (ix) general principles of infection and resistance; (x) bacterial diseases; (xi) tuberculosis; (xii) tuberculous conditions; (xiii) leprosy; (xiv) spirochetal and venereal diseases; (xv) rickettsial and viral diseases; (xvi) fungus infections; (xvii) protozoal and helminthic infections; (xviii) vitamins and deficiency diseases; (xix) neoplasms; (xx) the heart; (xxi) the blood and lymphatic vessels; (xxii) the kidneys; (xxiii) the lower urinary tract and male genitalia; (xxiv) the lung; (xxv) the organs of special senses; (xxvi) the lips, mouth, teeth, and neck; (xxvii) the gastrointestinal tract; (xxviii) the liver; (xxix) the gall bladder and bile ducts; (xxx) the pancreas; (xxxi) diabetes mellitus; (xxxii) the blood and bone marrow; (xxxiii) the spleen, lymph nodes, and reticulo-endothelial system; (xxxiv) the thymus; (xxxv) the pituitary gland (hypophysis); (xxxvi) the pineal; (xxxvii) the thyroid; (xxxviii) the parathyroids; (xxxix) the adrenals; (xl) the female genitalia; (xli) the breast; (xlii) the skin; (xliii) the bones; (xliv) the joints; (xlv) the nervous system; (xlvi) heredity and constitution in disease. Index.

This book is the result of the successful collaboration of 32 American pathologists, who represent 18 of the 48 United States of America. It weighs seven pounds, has 46 chapters, 1453 pages and 1183 illustrations. An almost staggering amount of detailed pathological information has been compressed between its covers, largely by the liberal use of small type. The illustrations, with few exceptions, are of good standard; an appreciable number is excellent.

Approximately one-third of the book deals with general pathology and in this section there are excellent chapters on chemical and physical injury and the effects of irradiation. The detailed treatment of the latter subject is fully justified by the widespread use of therapeutic irradiation, and the large amount of information presented could otherwise be obtained only by reference to special articles. The effects of atomic bomb injury are described. There is a clearly written and well-illustrated account entitled "Vitamins and deficiency diseases," by Henry Pinkerton. More



than one-fifth of the book deals with specific infections and there are special chapters on protozoal and helminth infections which, it is claimed, should now be included in any pathological textbook in view of the rapid progress of world-wide travel. Included also in the section on general pathology are several short chapters which introduce the student to major pathological problems. These are without exception clearly and carefully written. E. V. Cowdry's chapter on cells and their behaviour is stimulating and original. Paul R. Cannon writes a terse introduction of a few pages to the general problems of infection and resistance, and the introductory account of the general pathology of tumours by Shields Warren is one of the best in the book. There is an admirable chapter on the general pathology of tuberculosis by Francis D. Gunn.

Many of the sections dealing with special pathology are almost monographic. Ernest M. Hall's chapter on the special pathology of the heart occupies 70 pages and contains 309 references. The endocrine system is dealt with by the editor, W. A. D. Anderson, in six chapters occupying 88 pages and giving 507 references. Diseases of the blood and lymphatic vessels, the kidneys, the lung and liver are afforded the same almost encyclopaedic treatment. A commendable feature of the book is the special consideration given to diseases of the ear, nose, throat, and eye, of the skeletal tissues, the skin and the nervous system. It is claimed that these branches of pathology have previously received insufficient consideration in textbooks and there is obviously every justification for their inclusion in a book of this size. There is no doubt that these chapters add materially to the value of the book as a work of reference.

In almost all chapters considerable emphasis is laid on structural changes, but outstanding clinical features and the morbid physiology of disease receive attention, and neither bacteriology nor immunology are neglected. In some instances the correlation between altered structure and abnormal function could have been extended. There is a brief account of the consequences of abnormal function in liver disease but no corresponding general introduction to renal efficiency and failure in the chapter on the kidney. A short chapter on the functional efficiency of organs and the general principles of its estimation might well be included in the general pathology section. The descriptions of some common diseases, peptic ulcer for instance, are too brief having regard to their clinical importance, and it might be advantageous if a short general introduction to the reticulo-endothelial system were included in the earlier part of the book. This would provide the student with a demonstration of the part played by experimental pathology in the evolution of the subject.

There is no question that this book will take its place as an important contribution to pathological literature. Most of the earlier chapters on general pathology, especially the excellent account of inflammation by Morton McCutcheon, could be read with profit by the undergraduate medical student, but the chapters on special pathology are far too detailed for undergraduate study. To pathologists and clinicians it will prove to be an exceptionally useful reference book, especially with regard to recently acquired pathological knowledge.

G. Hadfield

## 1611 Textbook of Bacteriology. (Eleventh Edition of Muir & Ritchie's "Manual")

C. H. Browning & T. J. Mackie. Eleventh edition. London: Geoffrey Cumberlege, Oxford University Press, 1949. x + 907 pages; 226 figures. 25 × 16 cm. £2 10s. [£2.5]

(i) General morphology and physiology of bacteria; (ii) relations of bacteria to disease—infection—production of toxins by bacteria; (iii) immunity; (iv) bacteria associated with acute inflammation and suppuration—staphylococci and related organisms: streptococci; (v) the pneumococcus (*Diplococcus pneumoniae*); (vi) the meningococcus and gonococcus and allied organisms (Neisseriae); (vii) the diphtheria bacillus and allied organisms (Corynebacteria); (viii) the tubercle bacillus and the commensal and saprophytic acid-fast bacilli (Mycobacteria); (ix) the leprosy bacillus: bacillus of John's disease; (x) the anthrax bacillus; (xi) the bacilli of glands and melioidosis; (xii) bacillus pyocyaneus, bacillus proteus, and bacillus faecalis alkaligenes; (xiii) the coliform bacilli and the enteric group (the typhoid bacillus and the monella group of food-poisoning organisms; (xv) the bacillus of plague and allied organisms; (xvi) the bacillus of undulant fever and epizootic abortion (Brucella group); (xviii) the influenza bacillus, bacillus pertussis, and allied organisms; (xix) the cholera vibrio and allied organisms; (xx) the sporing anaerobic bacilli (Clostridia); (xxi) actino-

myces and allied organisms; (xxii) bacillus (or actinomycetes) necrophorus; bacteroides; bacillus fusiformis; bacterium pneumosintes; streptobacillus moniliformis; bacterium monocytogenes; erysipelothrix; organism of bovine pleuropneumonia and allied organisms: bacterium tularensis; (xxiii) *Treponema pallidum* and *Treponema pertenue*; (xxiv) spirochaetes of the relapsing fevers (*Borrelia obermeieri* or *recurrentis*; *Borrelia duttoni*, etc.); *Borrelia vincenti*; (xxv) *Leptospira icter*; (xxvi) the rickettsiae of typhus fever; (xxvii) general: neurotropic viruses—rabies, et al; and animals: lymphocytic viruses—smallpox and vaccinia; chickenpox; herpes simplex; molluscum contagiosum; warts; (xxix) viruses (continued)—yellow fever; Rift Valley fever; infective hepatitis and homologous serum jaundice; dengue; phlebotomous fever; psittacosis, etc.; lymphopathia venereum (lymphogranuloma inguinale); trachoma; inclusion conjunctivitis; (xxx) viruses (continued)—epidemic influenza, etc.; infectious coryza; virus pneumonia; measles; rubella; Durand's disease; infective mononucleosis; mumps; epidemic kerato-conjunctivitis; epidemic gastroenteritis; canine distemper; rinderpest; swine fever; virus myocarditis; infectious neoplasms of rabbits: virus diseases of domestic birds; (xxxi) bacteriophage; (xxxii) the pathogenic fungi; (xxxiii) pathogenic protozoa—malaria plasmodia; babesia (piroplasma); animal trypanosomes; (xxxv) pathogenic protozoa (continued)—leishmania; toxoplasma; (xxxvii) chemotherapy; (xxxviii) the bacterial flora of the normal skin and mucous membranes; (xxxix) the bacteriology of air, water, sewage, soil, and milk, from the hygienic standpoint. Appendix. Bibliography. Index.

"Muir & Ritchie" was first published 53 years ago, and many bacteriologists and others who began their studies with it will be glad that this outstanding textbook is being maintained. It now appears in a new format, the larger page and the use of small type for subsidiary matter enabling the subject to be treated as fully as in earlier editions, although the bulk of knowledge to be presented has, of course, greatly expanded. The authors have been successful in preserving the style of the original in adding to, or re-writing, the text.

The latter part of the book includes a full account of viruses, a chapter on the pathogenic fungi by R. Cranston Low, and four chapters on protozoology—exceptionally thorough treatment of this subject in such a work. There are, also, chapters on chemotherapy, the normal flora of the body, the bacteriology of air, water, sewage, soil, and milk, and a full appendix on methods. Finally, there is a classified bibliography of no less than 54 pages; this is so extensive that the average student may well recoil from it, and some of the citations, going back well into the last century, are of little more than historical interest.

The feature most likely to attract criticism is the use of the terminology of previous editions, in which, for instance, the generic name for every rod-shaped organism is "bacillus." In headings of sections dealing with specific bacteria modern equivalents are given only in brackets after the old nomenclature. Admittedly the new terminology is not even yet universally agreed or accepted, but surely the time has come when the well-recognized, more descriptive modern generic names should be used by every author. Their use is now required by the editors of almost every journal of standing published in the English language, and if in Britain we have not all yet gone so far as to adopt *Escherichia* and *Eberthella*, everyone knows what is meant when *Bacterium* and *Salmonella* are used instead. Other, though less important, features of previous editions of the book, the inclusion of which might well be reconsidered in the next edition, are occasional descriptions of named bacteria with uncertain claims to recognition as distinct species, and discussions of the value of vaccine treatment for various infections—the fact that after so many years the verdict often remains inconclusive or frankly sceptical surely suggests that some of these methods had better be forgotten. The description of antibiotics is rather cursory and brief, and it might well have been mentioned in Chapter X that bacilli are the source of many interesting substances of this kind.

The book has many solid merits. It contains far more detailed information than the majority of single-volume works on bacteriology, which should commend it to the more ambitious student who is not content with a book containing only the minimum that he should know. It stands in fact almost alone among British publications, in a position intermediate between the ordinary small textbook and the more encyclopaedic works of reference. It is profusely and, in general, well illustrated; some of the photographs, particularly of bacterial colonies, attain a high degree of excellence. As a source of detailed and accurate information it will be useful in many directions to the professional bacteriologist as well as to the advanced student.

L. P. Garrod



# 1612 Principles of Human Physiology

Originally written by E. H. Starling. Tenth edition by C. Lovatt Evans, with chapters on the special senses, by H. Hartridge. London: J. & A. Churchill Ltd., 1949. xii + 1193 pages; 693 illustrations. 25 x 16 cm. £2 2s. [£2.1]

(i) Introduction. Book I. General principles. A. Structural principles. (ii) The structural basis of the body. B. Biochemical principles. (iii) The elementary constituents of protoplasm; (iv) the proximate constituents. C. Biophysical principles. (v) The energy of molecules in solution; (vi) the properties of colloids; (vii) the passage of water and solutes through membranes; (viii) bioelectric potentials; (ix) enzymes and enzyme action. Book II. Tissues subserving movement and conduction—muscle and nerve. (x) Voluntary striated muscle; (xi) plain muscle and other contractile tissues; (xii) nerve fibres. Book III. Centralized control and co-ordination—the central nervous system. (xiii) General features of a central nervous system; (xiv) the receptors; (xv) the spinal cord and its relationship to the higher parts of the central nervous system; (xvi) the excitability of neurones and the properties of conduction at synapses; (xvii) characteristics of reflex actions; (xviii) the labyrinth, and postural reflexes; (xix) higher afferent paths; (xx) the cerebral hemispheres and the efferent paths; (xxi) functions of the cerebral cortex; (xxii) the cerebellum; (xxiii) the autonomic system: the hypothalamus; humoral transmission. Book IV. The supplying of information—the special senses. (xxiv) The nervous mechanism of sensation; (xxv) vision; (xxvi) hearing and speech; (xxvii) cutaneous sensations; (xxviii) sensations of smell and taste. Book V. Systems for distribution of materials—blood, circulation and respiration. (xxix) The blood; (xxx) general features of the circulation; (xxxi) physiology of the heart; (xxxii) factors which modify the heart's action; (xxxiii) dynamics of the circulation; (xxxiv) local regulation of blood flow; (xxxv) the pulmonary, hepatic and cerebral circulations; (xxxvi) examples of circulatory adaptation; (xxxvii) lymph, tissue fluids, and cerebro-spinal fluid; (xxxviii) the defence of the organism against infection; (xxxix) respiration; (xl) the regulation of the respiratory movements. Book VI. The intake of materials—nutrition, metabolism. (xli) The exchanges of matter and energy in the body; (xlii) the vitamins; (xliii) the normal diet of man; (xliv) the physiology of digestion—changes undergone by the foodstuffs in the alimentary canal; (xlv) the absorption of the foodstuffs; (xlvi) the history of the foodstuffs. Book VII. The removal of waste material and temperature conservation—excretion and temperature regulation. (xlvii) Renal excretion; (xlviii) the skin and the skin glands; (xlix) the temperature and heat-balance of the body. Book VIII. The provision of special chemical stimulants, and of measures for continuance of the species—the endocrine organs and reproduction. A. Endocrine organs. (i) The endocrine organs. B. Reproduction. (ii) The formation of germ cells; (lii) reproduction in man and other mammals; (liii) the secretion and properties of milk; (liv) heredity. Index.

In 1911 the Sharpey Scholarship at University College was awarded by Professor Ernest Starling to a candidate at the Second Medical Examination who was not a student of the College but an external candidate from Birmingham. The successful scholar was outstanding in his year and within two years was awarded the doctorate in science. He then qualified in medicine and, after a distinguished career in the First World War, progressed via the Chair of Physiology at Leeds, and the National Institute at Hampstead, to the Starling Chair at University College, from which he retired in 1949. With the Chair, Lovatt Evans inherited the principles of Starling in all senses of the word and the high tradition of this well-known book is maintained in this revised edition.

It is distinguished among books because the present author is qualified to speak and write from his personal research experience in both the biochemical and biophysical branches of physiology. In addition to authoritative discussion of the subject, the cultured, and wide but balanced, treatment it receives evinces itself particularly in this edition.

Each section is prefixed by a full and lucid account of the historical evolution of the present position. Collectively, the historical sections would make a co-ordinate history of physiology worthy of publication, as such, alone. In addition, physiology has been interpreted in a very wide sense, in that the ancillary aspects of biology which contribute to human physiology are brought into the picture, notably the basic principles of immunity, morphogenesis and genetics. Where a subject is treated lightly the reader is enabled to delve deeper by using the carefully selected references, both in the footnotes and at the chapter endings—a particularly useful feature of the book.

Probably, however, the most important feature is the excellent and thorough treatment that is given to the modern advances in biochemistry, and particularly the "bio" aspect of that subject, so often slurred over by the biochemist. This could not have been done if Evans' training and research had not been uniformly spread over both the chemical and experimental fields in the living animal or human being, as well as in the test-tube or colorimeter. There probably is no other university teacher living who could do this. The work is extremely up to date and is parallel with the growing points of physiology.

It would be invidious to point out the inaccurate footnote on p. 1135, or to suggest that this or that might be written more fully. The author has provided an up-to-date textbook of convenient size and a sound philosophy of true scientific method. In this, as in previous editions, the aid he has received from Professor Hamilton Hartridge, in the latter's own field of the special senses, adds lustre to the book. The gift possessed by this collaborator in describing the complex in simple words is well exhibited in this section.

This standard book is still pre-eminent as a scientific guide to human medicine. May it long remain so.

A. St. G. Huggett

# 1613 La Streptomycine

Marcel Morin, Jaques Nehllil & Remy Pichon. Paris: Masson et Cie, 1949. viii + 509 pages; 49 figures. 25 x 17 cm. 1950 fr.

Part I. (i) Historique; (ii) production; (iii) propriétés générales; (iv) récépération dans les urines; (v) autres substances antibiotiques élaborées par *Streptomyces griseus*; (vi) titrage de la streptomycine; (vii) action "in vitro"; (viii) traversée dans l'organisme. Absorption. Diffusion. Elimination; (ix) mode d'emploi; (x) toxicité; (xi) résistance secondaire à la streptomycine. Part II. (i) La streptomycine dans les infections liées aux bactéries hémophiles; (ii) la streptomycine dans les infections à *Klebsiella pneumoniae* (pneumobacille de Friedländer); (iii) la streptomycine dans les infections liées aux bactéries gram-négatives d'origine intestinale; (iv) la streptomycine dans les infections à *Pseudomonas aeruginosa* (bactérie pyocyanique); (v) la streptomycine dans la fièvre typhoïde et les salmonelloses; (vi) la streptomycine dans les shigelloses; (vii) la streptomycine dans le choléra; (viii) la streptomycine dans les brucelloses; (ix) la streptomycine dans les pasteurelloses; (x) la streptomycine dans l'infection à "*Streptobacillus moniliformis*"; (xi) la streptomycine dans les infections à "*Listeria monocytogenes*"; (xii) la streptomycine dans les infections à gonocoques (*Neisseria gonorrhoeae*); (xiii) la streptomycine dans les infections liées aux cocci gram-positifs; (xiv) la streptomycine dans l'infection charbonneuse; (xv) streptomycine et diphtérie; (xvi) streptomycine et infections à germes anaérobies; (xvii) la streptomycine dans les infections intestinales; (xviii) la streptomycine dans les infections hépato-biliaires; (xix) la streptomycine dans les infections urinaires; (xx) la streptomycine dans les infections génitales; (xxi) la streptomycine dans les infections pulmonaires non tuberculeuses; (xxii) streptomycine et péritonites chirurgicales; (xxiii) streptomycine et affections chirurgicales diverses; (xxiv) la streptomycine en neuro-chirurgie; (xxv) la streptomycine en oto-rhino-laryngologie; (xxvi) la streptomycine en ophtalmologie; (xxvii) la streptomycine dans la tuberculose; (xxviii) la streptomycine dans la lèpre; (xxix) la streptomycine dans les spirochétoses; (xxx) la streptomycine dans les infections à ultra-virus, dans les infections à pleuropneumonia, dans les rickettsioses et dans les infections à protozoaires; (xxxi) streptomycine et affections diverses. Bibliographie.

Ten years ago there was but one antibiotic of practical therapeutic value; today there are four of paramount importance and nearly two hundred others which, either because of their limited chemotherapeutic effect, their inactivation by serum, or their toxicity, have not as yet found a place in the treatment of human diseases. So rapid has been the development of antibiotic therapy that it would now be almost impossible to keep abreast of every development were it not for the appearance of books such as this volume by Dr Morin and his collaborators from the Clinique des Maladies Infectieuses of the Paris Faculty of Medicine. This work of more than 500 pages is briefly introduced by Professor Mollaret, after which there are chapters on the history, production and chemistry, and general properties of streptomycin. The next two chapters deal with other antibiotics produced by *Streptomyces griseus* and the amounts present in the urine. The titration of streptomycin, its in vitro action, and its pharmacology, are then considered, together with the methods of application, toxicity, and the development of bacteria resistant to streptomycin.

Thereafter the action of the antibiotic on specific infections is considered. Of special value is the long and detailed chapter on tuberculous infections. This chapter, like many others, contains a large amount of original work carried out in the authors' own clinic; in addition, many Continental observations not readily available to readers in Britain are ably summarized. Not the least valuable feature of this important volume is a bibliography of 30 pages, the full titles of the original papers being given. This book will be indispensable to all those who are working or propose to work on streptomycin. There are only two possible criticisms: firstly, as with so many French books, there is no index, and secondly, the binding is so bad that in a very short space of time the cover comes adrift and the book begins to disintegrate.

G. M. Findlay

## HISTORY AND BIBLIOGRAPHY

## 1614 Tom Cullen of Baltimore

Judith Robinson. Toronto: Oxford University Press; London: Geoffrey Cumberlege, 1949. xii + 435 pages; 20 illustrations. 24 x 16 cm. £1 5s. [£1.25]

Part I. Canadian preparation. Part II. Hopkins beginnings. Part III. Continuing in Baltimore. Part IV. Achievements. Part V. The fighting years. Part VI. "What's best for the patient . . ." Part VII. Getting things done. Appendix: published works. Index.

This handsome production of the Toronto branch of the Oxford University Press, written by a Toronto journalist, is addressed to the general public, but should not be missed by anyone interested in gynaecology, in echoes of Osler, or in the growth of the Johns Hopkins Hospital and its Medical School and Bulletin. The subject of this biography is the discoverer of "Cullen's sign", the inventor of the forceps bearing his name, and the author of the now classical books on cancer of the uterus, adenomyoma of the uterus, myoma of the uterus, and the embryology, anatomy and diseases of the umbilicus. His many papers bear witness to his belief in publication—not for its own sake, but for permanent record and in order to pass on results to both research workers and clinicians; this belief was also largely responsible for the valuable volumes of collected papers of his department.

The critical reader may in this case profitably look beyond journalese and over-emphatic chapter titles to the account of the achievements of this great surgeon and teacher and of the developments in his field and in Johns Hopkins which have coincided with his long and fruitful career. When young Tom Cullen finished a year's internship in the Toronto General Hospital, he had the opportunity to assist at an operation performed by Dr Howard Kelly, gynaecologist-in-chief of Johns Hopkins; that experience turned him from medicine to surgery, and with characteristic decision he immediately obtained the promise of a junior internship with Kelly. The next September he started humbly enough on his work among the giants of Hopkins' early days—the head of the medical department was another Canadian, Dr William Osler—with a preliminary three months in pathology, under William H. Welch. Cullen was later to refuse offers from elsewhere of greater seniority and reward, in order to stay with the department of gynaecology at Hopkins; in 1938 he retired from its direction at the age of seventy—a retirement which was an expansion into even fuller public activities than before. Since then the Johns Hopkins' Professor Emeritus of Gynaecology has returned once or twice each year, at the invitation of his successor, to conduct his operative clinics. Although he has a reputation as a great teacher, Professor Cullen himself claims he has never "taught" students: "I just try to show them what there is to learn. It's all anybody can do."

This is the story of a life bridging several generations and two worlds—the present with that nostalgic past when an impecunious young transatlantic research worker not only successfully controverted von Recklinghausen, but at a day's notice left for a spring and summer in Europe, where he visited Leyden and Göttingen, learned German by using it, and worked in the laboratory of Johannes Orth, *Lieblingsschüler* of Virchow. It is also a book full of the charm and vitality of its central figure and the ceaseless flow of his anecdotes about colleagues, patients, and plain people. It can hardly fail to interest anyone who reads it.

H. P.

## 1615 The Healing Touch

Harley Williams. London: Jonathan Cape, 1949. 408 pages; 8 illustrations. 20 x 14 cm. 15s. [£0.75]

Part 1. Three royal physicians. (i) Sir William Knighton, Bart.; (ii) Sir James Clark, Bart.; (iii) Sir William Jenner, Bart. Part 2. Two prophets. (i) Sir Edwin Chadwick; (ii) Thomas Southwood Smith. Part 3. Florence Nightingale. Part 4. Charles Edouard Brown-Séquard. Part 5. A new world of medicine. References.

The "healing touch" of which Dr Harley Williams writes is an "instinctive faculty" which "can produce prodigious improvements in our tough human material." He has selected a series of remarkable men and women (not all doctors) of the last century and a half, in whom this faculty expressed itself and who, through their personality, influenced medical progress and altered the attitude of ordinary people to health and sickness. The book is written

for non-specialist readers and is superficially a piece of journalism, chatty and sometimes cheap. It is, however, more serious than at first appears. Dr Williams is attracted by contrasts, both within the individual and in historic relationships, and his character sketches are in consequence vivid if not profound. He ranges from court physicians, with little scientific knowledge but with a gift for managing such august and difficult patients as George IV and Queen Victoria, to the self-effacing Mayo brothers, who devoted their lives to the development of a first-class surgical centre in the Middle West. Between these extremes he sketches the English prophets of the new hygiene, Edwin Chadwick, Thomas Southwood Smith, and Florence Nightingale, and the cosmopolitan conjurer of physiology, Brown-Séquard, a character of contradictions after Dr Williams' heart.

A startling and tragic contrast is the story of the Prince Consort's death. Ignorance of proper nursing was a contributory factor, yet only a year earlier Florence Nightingale had sent Queen Victoria, who knew and admired her, a copy of *Notes on nursing* which was intended to make the essentials of nursing clear to every educated woman. Dr Williams tells the story and points the moral admirably.

Many great figures make brief appearance between the principal actors. Florence Nightingale, with her fanatical sense of vocation, is contrasted with Elizabeth Fry, who led a full normal life while carrying on her philanthropic work in the prisons. The mystic Southwood Smith was a devoted disciple of the extravagantly matter-of-fact Bentham. Brown-Séquard, born in Mauritius of mixed French and Irish-American parentage, moving feverishly between France, England and America, was the successor of Claude Bernard, who lived for his small laboratory.

The chapter on the Mayo brothers summarizes the story of modern surgery and includes a clever thumb-nail impression of John B. Murphy, and more extended appreciations of Virchow and Billroth, of "Popsy" Welch, William Stewart Halstead and Harvey Cushing.

W. R. Le Fanu

## 1616 Hindu Medicine

Henry R. Zimmer. Edited by Ludwig Edelstein. Baltimore: Johns Hopkins Press; London: Geoffrey Cumberlege, Oxford University Press, 1948. lxxii + 203 pages. 20 x 14 cm. £1 12s. [£1.6]

Introduction. (i) Medical tradition and the Hindu physician; (ii) the human body: its forces and resources. Notes to Introduction. Notes to Chapter I. Notes to Chapter II. Index of passages.

The late Professor Zimmer gave the Hideyo Noguchi lectures at the Johns Hopkins Institute of the History of Medicine in 1940. When Zimmer died on 20 March 1943, the first lecture and most of the second had been extensively revised and rewritten, but there were only brief notes on the problems to be dealt with in the third chapter. Dr Ludwig Edelstein who edited this material has had the first two lectures printed as they stood.

The first lecture is concerned with medical tradition and the Hindu physician. It describes the complexity of magic cures; the many-sided approach to the disease-demon; the elaborate spells to ensure the complete effectiveness of amulets, special foods, and ceremonial gestures; and, throughout the cure, the appeal by suggestion to the patient, who is made aware of the whole process and progress of healing. A hymn of 28 stanzas, part of a medical rite for cases of consumption, is translated and annotated, as is a long chant from the Vedic pharmacopoeia. An important asset of the Hindu magician-physician was his ability to league himself with all the divine healing forces. He could call upon the divine powers and spiritual energies of all the herbs he used. The close relationship of religious philosophy—there was no other philosophy—with medicine is reflected in the Four Noble Truths of Buddhism, which correspond exactly to the four successive problems that the physician must formulate and solve in treating any patient. The works of Suśruta in the fourth century and Caraka in the first century A.D. differed only in essentials from the 17th century Jivānanda and all three show Hindu medicine and surgery as an integral part of philosophy and religious life.

This first lecture, which sets medicine against the wide cultural background, leads naturally to the second lecture—on the Hindu

view of the human body. The body, like the whole universe, is held to be a manifestation of divine substance and energy, and its principal faculties and forces are the microcosmic counterpart of all the powers and processes in the world. This concept and its variations are traced from pre-Aryan antiquity to the latest classic system of the Tantras and to the technique of Yoga, which is intended to bring into consciousness the essence of the five elements—aether, air, fire, water, and earth. This correspondence between microcosm and macrocosm is important in Hindu medicine. The three humours, for example, wind, bile, and phlegm, represent three divine universal forces, wind, sun, and moon. The aim of the Yoga adept is to fill with concentrated wind or life-breath the two channels which begin at the nostrils, and, crossing and entwining the spinal column, descend to the sacrum. One channel is related to the lunar and the other to the solar forces. Hindu medicine lists five kinds of life-breath, Yoga ten, and none of them is related to the lungs—the principal seat of phlegm. The three humours and the blood share the 700 tubular vessels in the body, all of them taking origin from the navel. After analyzing this schematic speculative anatomy, Zimmer goes on to compare Greek medicine in its most dynamic phase with the static conservatism of traditional Hindu medicine. Greek and Hindu beliefs about generation and gestation are also contrasted; there, unfortunately, the unfinished second lecture ends abruptly.

This is a book that no one who is interested in the history of medicine can neglect. It is fragmentary and unfinished. There are omissions and repetitions, and a number of interpretations which are not likely to meet with general acceptance. Yet it is impossible to reach the last page without a feeling of frustration and deep regret—frustration because this is the beginning and the middle only of an important thesis, regret because Zimmer was not spared to write the third and last section.

I.H.F.

### 1617 Discoverers for Medicine

William H. Woglom. New Haven, Conn.: Yale University Press; London: Geoffrey Cumberlege, 1949. x + 229 pages; 14 illustrations. 24 × 16 cm. 18s. [£0.9]

(i) Introduction; (ii) the blood pressure; (iii) respiration; (iv) the foxglove; (v) vaccination; (vi) the laryngeal mirror; (vii) the Eustachian tube; (viii) eye-glasses and spectacles; (ix) the itch; (x) quinine; (xi) phagocytosis; (xii) X rays; (xiii) heredity; (xiv) milk sickness. Bibliography. Index.

The meaning of the rather curious title which Dr Woglom has given his book becomes plain only after his introduction is read. The author has set out to give an account of some of the notable contributions made to medicine by laymen, and the proposition in

the title is intended to suggest this distinction. In most of the 14 separate studies in this volume the discovery is credited to an individual; e.g., Stephen Hales (blood pressure), Manuel Garcia (the laryngeal mirror), and Benjamin Franklin (spectacles). In others, it is attributed to the vast anonymous herd who sustain and enlarge popular tradition; e.g., the folk tradition about the use of the foxglove, cowpox inoculation, etc.

It is an interesting conception, and the natural antithesis to the many studies of the debt that is owed to medical men by workers in other fields. Unfortunately, this book fails to convince us that any new light can be thrown on medical history by such an approach. As the bibliographies at the end of the book indicate, all the subjects dealt with here have been studied in greater detail elsewhere, so that this book will interest the general reader or the student rather than the historian who is already acquainted with the standard works on the subject.

In spite of the author's persuasive introduction it is debatable how far such figures as Metchnikoff, Roentgen, Hales, or Pasteur (who is omitted here) can be regarded as "laymen". Hales was as much a physiologist as any occupant of a modern chair; the only distinguishing factor is that he did not earn a living by his physiological studies but as the "perpetual curate of Teddington". Roentgen, already a celebrated physicist when he discovered x rays, made a discovery within his own field of knowledge. That its applications have been so momentous in the advance of medicine is due to the work of medical men (e.g., Cannon) who immensely extended the range of its usefulness. Metchnikoff is not the only biologist whose work has forwarded medical knowledge. Surely it shows a lack of historical perspective to regard such men as amateurs. The fact that they were not doctors of medicine with diplomas duly signed and sealed seems quite unimportant.

As for the non-professional laymen such as Jesty, and the first unknown herb-gatherers who discovered the virtues of foxglove, how does their "work" compare with that of the medical men who established vaccination and digitalis in regular medical practice? We are told, a point overlooked by Dr Woglom, that country women in Ireland 100 years ago used the mould *penicillium* for cuts and wounds, but should they be set beside Fleming and Florey as "discoverers"?

But perhaps this is captious criticism of a very readable book which, while adding nothing to our knowledge, gives useful short accounts of the background of a number of important medical advances. The book is a product of the widespread interest in medical history in the United States and was originally published by the Yale University Press.

F. N. L. Poynter

## PARTICULARS OF BOOKS REVIEWED ELSEWHERE

### PARTICULARS OF BOOKS REVIEWED ELSEWHERE IN THIS NUMBER

The numerals in square brackets are the serial numbers of the articles in which these books are reviewed

#### [1539] Antibiotics : a Survey of Penicillin, Streptomycin, and Other Antimicrobial Substances from Fungi, Actinomycetes, Bacteria, and Plants. Vols. I & II

H. W. Florey, E. Chain, N. G. Heatley, M. A. Jennings, A. G. Sanders, E. P. Abraham, M. E. Florey. London : Geoffrey Cumberlege, Oxford University Press, 1949. xxii + 1774 pages ; 265 figures. 25 × 16 cm. £8 8s. [£8.4]

Vol. I : Part I. (i) Historical introduction. Part II. General experimental methods. (ii) Detection and extraction of antibacterial substances ; (iii) the assay of antibiotics ; (iv) methods for measuring the sensitivity of micro-organisms to antibiotics ; (v) antibiotics in differential culture media. Part III. Antibiotics from fungi—general considerations. (vi) Review of species examined. Part IV. Antibiotics from fungi—substances other than penicillin. (vii) Substances produced by fungi imperfecti and ascomycetes ; (viii) substances produced by basidiomycetes, phycmycetes, and unidentified fungi. Part V. Antibiotics from actinomycetes. (ix) Substances other than streptomycin. Part VI. Antibiotics from bacteria. (x) Antibiotics from bacteria in the genus *Bacillus* ; (xi) antibiotics from other bacteria ; (xii) antibiotics from chromogenic bacteria. Part VII. Antimicrobial substances from lichens, algae, and seed plants. (xiii) Substances from lichens and algae ; (xiv) substances from seed plants. Vol. II : Part VIII. Penicillin. (xv) Historical introduction ; (xvi) penicillin-producing fungi ; (xvii) the production of penicillin ; (xviii) extraction and purification of penicillin ; (xix) metabolic changes during penicillin fermentation ; (xx) the chemistry of penicillin. Historical introduction ; (xxi) physical and chemical properties of the penicillins ; (xxii) the components of the penicillin molecule ; (xxiii) hydrogenolysis products of penicillin ; (xxiv) penicillin sulphone, penicillin sulphoxide, and the thiocyanate derivative of penicillin ; (xxv) products of isomerization of the penicillins ; (xxvi) thiazolidines and  $\beta$ -lactams ; (xxvii) the structure of the penicillin molecule ; (xxviii) attempts to synthesize the penicillins ; (xxix) modifications of *p*-hydroxybenzylpenicillin ; (xxx) biogenesis of penicillin ; (xxxi) the activity of penicillin against micro-organisms ; (xxxii) methods of testing material containing penicillin for sterility ; (xxxiii) penicillinase ; (xxxiv) acquired resistance of micro-organisms to penicillin ; (xxxv) the action of penicillin on micro-organisms ; (xxxvi) the combined action of penicillin with other drugs ; (xxxvii) the pharmacology of penicillin. Toxicity ; (xxxviii) the pharmacology of penicillin. Absorption ; (xxxix) the pharmacology of penicillin. Distribution in the body ; (xl) the pharmacology of penicillin. Excretion and loss in the body. Part IX. Streptomycin. (xli) Production and isolation of streptomycin ; (xlii) chemical properties and structure of streptomycin ; (xliii) the activity of streptomycin and dihydrostreptomycin against micro-organisms ; (xliv) acquired resistance of micro-organisms to streptomycin ; the action of streptomycin ; (xlv) the pharmacology of streptomycin and dihydrostreptomycin ; (xlvi) mannosidostreptomycin (strepto-

mycin B), other streptomycins, and streptomycin residues. Part X. (xlvii) The action of antibiotics on bacteria. Part XI. (xlviii) Conclusions. Appendix and tables of antibiotics. Bibliography. Author index. Subject index.

#### [1541] Publicaciones del Instituto de Historia de la Medicina. Vol. XII, Nos. I & II

Anibal Ruiz Moreno. Buenos Aires : Universidad de Buenos Aires, Facultad de Ciencias Médicas, 1948. No. I : 204 pages. 24 × 17 cm. No. II : 151 pages. 24 × 17 cm.

No. I : *Obras de Galeno*. (i) Advertencia ; (ii) compendio del pulso para los estudiantes ; (iii) de las diferencias de pulsos ; (iv) índice de temas ; (v) índice de autores citados y otros nombres propios ; (vi) índice de referencias a otras obras de Galeno ; (vii) vocabulario de términos técnicos.

No. II : *Tratado de la viruela y el sarampión por Abū Bakr Muhammad Ibn Zakariyā (Razés)*. (i) Vida y obras de Razés ; (ii) estudio de la obra ; (iii) *Kitab Al-Jadari Wa-Al Hasba* (tratado de la viruela y el sarampión) ; (iv) referencias sobre viruelas y sarampión, que se encuentran en el *Kitab Al-Mansuri* ; (v) referencias sobre viruela y sarampión que se encuentran en *Divisio Morborum* ; (vi) referencias sobre viruela y sarampión que se encuentran en *Kitab Al Hawi*.

*La Sanidad militar en la guerra del Brasil*. (i & ii) Consideraciones generales ; (iii) organización de la campaña sanitaria ; (iv & v) la acción de armas decisiva. Ituzingó. Apéndice.

#### [1545] Paul Ehrlich

Martha Marquardt. With an introduction by Sir Henry Dale. London : William Heinemann Medical Books Ltd., 1949. xx + 255 pages ; 52 illustrations. 22 × 14 cm. £1 5s. [£1.25]

(i) Childhood and schooldays ; (ii) at the University ; (iii) at the Charité Clinic, Berlin ; (iv) research with Robert Koch and Emil von Behring ; (v) the Steglitz Institute ; (vi) the Frankfurt 'Serum-Institute' ; (vii) the 'side-chain' theory ; (viii) an evening at home ; (ix) 'side-chains' and 'magic bullets' ; (x) stimulants and diversions ; (xi) lectures and publications ; (xii) serumtherapy and chemotherapy ; (xiii) the Georg Speyer-Haus ; (xiv) atoxyl and other arsenicals ; (xv) personal characteristics and the Nobel prize ; (xvi) 606 ; (xvii) invention of 606 announced to the world ; (xviii) Salvarsan—early troubles ; (xix) Königsberg Congress and later troubles ; (xx) Ehrlich and his grandchildren ; (xxi) more discoveries in syphilis ; (xxii) Ehrlich's sixtieth birthday ; (xxiii) honours and appreciation ; (xxiv) slander and libel ; (xxv) the final year.

#### [1546] The Personality of William Harvey

Geoffrey Keynes. London : Cambridge University Press, 1949. 48 pages ; 8 illustrations. 19 × 13 cm. 5s. [£0.25]

(i) The personality of William Harvey ; (ii) abbreviated list of authorities ; (iii) illustrations.

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## Shorter Notices

### Trends in Medical Education. The New York Academy of Medicine Institute on Medical Education, 1947

Edited by Mahlan Ashford. New York: The Commonwealth Fund; London: Geoffrey Cumberlege, 1949. xiv + 320 pages. 22 x 14 cm. £1 4s. [£1.2]

The Committee on Medical Education of the New York Academy of Medicine held six conferences on medical education in April 1947; more than fifty prominent persons were present, and this volume records the fruits of their deliberations. The contributors include deans and professors in medical schools, specialists in all branches of medicine, general practitioners, and even educationalists concerned with future medical students in secondary schools and universities. It is not, therefore, surprising to find that the book contains diverse and irreconcilable opinions; indeed, there are perhaps more points of disagreement than the reverse.

Some conclusions, however, do emerge: there is no doubt that in American medicine specialization is increasing and that the undergraduate and postgraduate programmes are changing and will be further modified to meet the requirements of the would-be specialist. This is, of course, most striking in the postgraduate field; carefully graduated courses of five years and longer are being followed by increasing numbers of neophytes aspiring to the accolade of specialism.

The discussion reflects a considerable degree of uncertainty about the role of the general practitioner; there is general agreement that the family physician is necessary, but considerable doubt about what he should do and even graver uncertainty as to how he should be trained. The development of group practice in the smaller communities might, some contributors felt, be the logical step in the further evolution of medical practice.

The book gives an excellent cross-section of American conditions and opinions in this field which is the scene of so much controversy. Medical educators in countries other than the USA will find it useful to compare and contrast with their own experiences and opinions.

D. F.

### Tuberculosis Nursing

Jessie G. Eyre. London: H. K. Lewis & Co. Ltd., 1949. xii + 291 pages; 103 illustrations. 22 x 14 cm. £1 1s. [£1.05]

This comprehensive and well-illustrated book, by the Senior Sister Tutor of St. Helier Hospital, Carshalton, England, fills a gap in nursing literature. It is intended as a guide to those wishing to gain additional postgraduate experience or to specialize in tuberculosis nursing. The author gives considerable attention to collapse therapy and chest surgery, in which branches the modern treatment of pulmonary tuberculosis has most developed; the care of the patient in hospital is also dealt with. Other chapters of special interest are those on chemotherapy (including the use of streptomycin, calciferol and *para*-aminosalicylic acid), on tuberculosis of bones and joints, and on the care and after-care of tuberculous patients.

H. M. C.

### Food Inspection Notes. A Handbook for Students

H. Hill & F. Dodsworth. Third edition. London: H. K. Lewis & Co. Ltd., 1949. viii + 125 pages; 17 x 11 cm. 7s. 6d. [£0.375]

This little book is addressed primarily to the student food inspector. Its aim is to give him the essentials of food inspection in concise form and in this it succeeds admirably. As the title suggests, the material is set out in note form throughout. The first half of the book is devoted to meat inspection under the headings of ante-mortem inspection, slaughter-houses, slaughtering and dressing, anatomy and physiology, and diseases of animals. This last section is particularly useful. Each disease is briefly but clearly described and in each case the description concludes with a "judgment," i.e. action to be taken by the food inspector. To give just two examples, for rheumatism the "judgment" is: "Consider on merits. Joints affected, removed and condemned. If general emaciation, carcase and organs condemned"; and for anthrax: "Notifiable disease, special Order. Carcase and organs condemned."

The second half of the book deals with the examination of poultry, game, milk, canned foods and miscellaneous foods. The chapter dealing with food-poisoning is not up to the standard of the rest of the book and requires bringing up to date. It is not now true that canned meat and salmon are the commonest causes of poisoning by the *Salmonella* group, or that the *staphylococcus* is only occasionally a cause of food poisoning. The last chapter deals briefly with the technique of food sampling.

The book has the great merit of being essentially practical in its approach. The authors have concentrated upon providing the facts which the practising food inspector must know. This, coupled with the arrangement in note form, means that the book cannot be, and is not intended to be, a substitute for a textbook. The handling of food is of course mentioned incidentally in various places, but in view of its increasing importance it would merit a special chapter in future editions.

It is clearly impossible for a book of this type to deal adequately with legislation and the authors have chosen to omit this altogether. Nevertheless, the food inspector works in practice within the framework of legislation and must always keep in mind his legal duties and legal powers. For this reason, the value of the book to the student would be enhanced if the relevant legislation were cited, say, as footnotes.

D. B. Bradshaw

### Meet Yourself at the Doctor's

Mass-Observation, with drawings by Ronald Searle. London: The Naldrett Press, 1949. 70 pages; 20 illustrations. 19 x 12 cm. 3s. 6d. [£0.175]

After a spate of publications concerning the National Health Service, its administration, its legal aspects, its finances and the first year's working, this attempt to evaluate the reactions of men and women of all classes is illuminating and amusing. There are comments made by the public before and after the adoption of the Act; there is a comparison of the points of view of Dr D. and Dr Y., and the story of the doctor's working day. One chapter reports on conversations heard in the waiting-room and another on accounts by patients of procedure inside the surgery. The attitude of mothers to the infant-welfare service and the protests of those who still prefer such alternatives to state medicine as osteopathy and Christian Science are also dealt with. Against evidence of overwork and waste of time and money has to be set a woman's comment, "It's everything to a mother to know that you can

call the doctor even when you haven't the money ready." Written with serious intention, the text and conversations present a well-balanced assessment of human reactions, to which Ronald Searle's illustrations give gaiety.

H. M. C.

### Gas and Air Analgesia

R. J. Minnitt. Fourth edition. London: Baillière, Tindall & Cox, 1949. vii + 86 pages; 22 figures; 18 x 12 cm. 5s. [£0.25]

The 4th edition of this excellent handbook for midwives has now been published. As would be expected from the originator of the method, it is authoritative and contains all that the midwife needs to know. It will also prove useful to those anaesthetists entrusted with the preparation of lectures to midwives on analgesia.

The text remains substantially the same as that of the previous editions except that some of the details of technique have been elaborated. The latest regulations of the Central Midwives Board have been included. The print, paper, illustrations and binding are alike excellent, and the book should be able to withstand the hard wear to which it will doubtless be subjected.

C. Langton Hewer

### Temas de Tisiología

José F. Verna et al. Córdoba, Argentina: Imprenta de la Universidad, 1949. 271 pages; figures. 23 x 16 cm.

Professor Verna and his associates are to be congratulated on this volume; they have succeeded in presenting a group of papers on tuberculosis, ranging from the technique of thoracoplasty to the radiology of intestinal tuberculosis. The first paper, by Professor Verna, deals with pulmonary tuberculosis and cancer; he points out that pulmonary tissue already damaged by tuberculous infiltration is not less favourable to the growth of neoplasm than any other tissue equally damaged by a pathological process. Although tuberculosis may develop in a neoplastic lesion, the reverse process is more frequent. Tuberculosis may establish a predisposition to cellular metaplasia, and once both processes are co-existent, their further evolution is somewhat independent of each other. It has been found that carcinoma grows more readily on tuberculous lesions which are still active; this is perhaps due to the scanty or absent fibrous tissue reaction of the active lesion.

After a discussion of the relationship between tuberculosis and climate by Professor Sarmiento, Professor Sonzini describes the anatomy and surgical technique of thoracoplasty, following the principles expounded by Finochietto and his colleagues in Argentina. This operation stresses separation rather than division of muscles; it has not met with much enthusiasm in Britain, as ample exposure is considered far more important than the avoidance of muscle splitting. Professor Menso gives a brief review of intrathoracic pathology and lung resection, and there is also a short paper on Kahn's reaction in plasma, by Dr Manavella. In his paper on the re-inoculation of the previously tuberculinized guinea-pig, Dr Astrada reaches the interesting conclusion that tuberculin diminishes the phagocytic power of leucocytes against the tuberculous organism, rendering the animal more susceptible to the action of the injected germ.

The paper on the radiology of intestinal tuberculosis, by Professor Moreno, is well presented, and deals with the differential diagnosis of this condition. The various other papers which complete the volume are also of great interest; the book will no doubt be eagerly read by many workers, both laboratory and clinical, in the field of tuberculosis.

A. J. Cœllo



# Books Received

September 1949—January 1950

Reviews of many of these books appear in this number of the *Bulletin* or will appear in future numbers

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